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How much is corporate cash-pooling worth?

Modelling and simulation

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Abstract

The paper analyzes a special corporate banking product, the so called cash-pool, which gained remarkable popularity in the recent years as firms try to centralize and manage their liquidity more efficiently. The novelty of this paper is the formalization of a valuation model which can serve as a basis for a Monte Carlo simulation to assess the most important benefits of the firms arising from the pooling of their cash holdings. The literature emphasizes several benefits of cash-pooling such as interest rate savings, economy of scale and reduced cash-flow volatility. The presented model focuses on the interest rate savings complemented with a new aspect: the reduced counterparty risk toward the bank. The main conclusion of the analysis is that the value of a cash-pool is higher in case of firms with large, diverse and volatile cash-flows having less access to the capital markets especially if the partner bank is risky and offers a high interest spread. It is also shown that cash-pooling is not the privilege of large multinational firms any more as the initial direct costs can be easily regained within a year even in the case of SMEs.

Keywords: corporate cash management, banking transaction services, cash-pool, Monte-Carlo simulation, net interest spread, counterparty risk

JEL-Codes: G15, G21, G32

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1. Introduction

General *corporate cash management* is one of the elementary topics of corporate finance. It is discussed in almost all basic corporate finance textbooks (e.g. Brealey-Myers, 2005). Cash management issues of multinational corporations, corporate groups require even more complex solutions; therefore international management books discuss the topic even more in detail (e.g. Siddaiah (2010) or Madura (2010)). Cash management in the literature is usually presented as a sub-topic of *liquidity management*, mostly as a part of *working capital management*. The most important issues discussed under these keywords are: (1) cash flow planning, its efficiency, accuracy, and important techniques; (2) control on cash, cash collection and disbursement, the usage of cash; (3) optimal cash management theories and models, see Baumol (1952) and Miller-Orr (1966).

The literature of efficient cash management models concentrates also on the issues of fast collection and slow disbursement, and on the optimal utilization of the cash. However, before a company can structure the processes of optimal collection and disbursement it has to optimize its intragroup payment activity first. It is always a controversial question whether the company should apply a centralized or a decentralized cash management approach. Most of the authors argue for centralized cash management, as it leads to higher level of consolidation, which implies lower financing requirements and offers more investment opportunities, moreover, it has the advantage of the economy of scale, and a better negotiation position towards commercial banks (See e. g. Madura, 2010, pp 600). Textbooks often add that due to a centralized cash-management extra costs can also be avoided, and reporting, banking relations can be simplified (Kilkelly, 2011). However, centralization has several disadvantages too. Flexibility decreases, as the reaction time of the units is decreased, which can easily cause demotivation and the organizational resistance (Oxelheim-Wihlborg, 2008). Regulatory and tax issues may also cause several inconveniences and delays, which may lead to higher transaction costs (Siddiah, 2010, pp 314.).

Banks offer several products to serve companies in their centralized cash management processes, and these products have gained top priorities in the current banking product palette. In the recent years separate *cash/transaction management divisions* have been set up in most commercial banks. There are numerous reasons why these areas have gained such a serious attention inside banking organizations. On the one hand, due to the strict capital requirements the role of non-credit type services and their stable fee revenues have become more important to all commercial banks. On the other hand, these services are also important to anchor clients to the bank. Moreover, the implementation of SEPA (Single Euro Payments Area), the continuous developments in the general IT infrastructure also offer the opportunity to merge even cross border cash flows easily and cost efficiently. Finally, as products become more and more complex, they require special know-how, which automatically supports the establishment of specialized departments.

Section 2 presents those services that support the centralized cash management. In Section 3 the basic factors of benefits and costs of cash-pooling are summarized from corporate point of

view. In Section 4 a model and the corresponding simulations are presented, which gives an estimate of the value added coming from the interest savings and from the reduced counterparty risk of a simple cash pool set up under different parameters. In Section 5 results are discussed, while in Section 6 conclusions are derived.

2. Banking services for centralized cash management⁴

Centralized cash management simplifies and reduces intercompany transfers and cash movements. This is why *payment netting systems* were born, where payment deadlines are standardized and all claims and settlements are settled periodically based on the principle of netting (Hillman, 2011; Siddiah, 2010). The netting of payments is not exclusively a banking service, several financial institutions offer similar products or even the company can develop its own IT solution. If there is substantial cross sale within the group, netting can produce considerable savings in transaction costs, in the FX conversion⁵ by reducing internal banking transfers. It can also reduce the financing needs and expenses (Kilkelly, 2011). Payment netting systems optimize internal corporate transactions and settlements, however, do not optimize and centralize the cash management of the company. It is offered by another product group: the so called cash-pool systems.

One of the modern centralized cash management products offered by almost all commercial banks is the *cash-pool*. In today's terminology all structured processes where bank accounts of a group of corporations are combined are regarded technically as cash-pools. In a cash-pool system accounts of different companies (even of different legal entities) are introduced into a single bank account structure settled in a mutual cash-pool agreement. It centralizes all balances of the sub accounts into a central master account. Amounts are consolidated and deposit and credit interest rates are automatically calculated and charged. Companies participating in a cash-pool sign a mutual agreement, which settles the framework and the structure of the cash-pool and all relevant conditions. Participating companies also sign a contract with the commercial bank that manages the accounts under the agreed banking terms and conditions. Commercial banks offer different cash-pool systems, however structures can be grouped into two main standard types of solutions (1) *cash concentration* (or also called *physical cash pool*); (2) *notional cash pool*. Which type of cash-pool is more in common in a given region or country mainly depends on the tax, accounting and other legislations.

The objective of a *cash concentration* is to physically concentrate all liquid assets of the group in order to reduce the external financing need of the whole company and to use the collected cash elements in an optimal way especially in order to exploit the economy of scale. (Dolfé-Koritz, 1999). The simplest and most wide spread form of cash concentration is the so called zero-balancing cash pool. Usually, the parent company holds the "master account", and the "sub-accounts" (called "pooling accounts" or "slave accounts") are connected to the master account in accordance with the pre-defined hierarchy. The surplus on the pooling

⁴ For more detailed description and analysis of the products and their different types see Walter-Kenesei (2015).

⁵ FX risk hedging solutions are described in Dömötör-Havran (2011)

accounts is regularly transferred onto the master account; and vica versa, if the balance of the sub-account is negative, then the necessary amount to offset the negative balance is transferred automatically from the master account. In order to handle the intraday negative balances, banks usually set up an intraday overdraft facility on the sub-accounts. At the end of the day the master account shows the total net balance of all accounts joint in the cash-pool system. Technically, the company owning the master account handles the transactions among the sub-account holder companies as bilateral intercompany loans. The bank calculates and settles the interest based on the balance of the master account and charges only the master account holder. Determination, booking and settlement of the intercompany interest charges or incomes are the tasks of the central corporate treasury.

The *notional cash-pool* does not require real cash movement and transfers. It is essentially a tool of interest optimization, where interest is calculated on the netted amount of all combined accounts (Dolfe–Koritz, 1999; Hillman, 2011). Beside these basic solutions many other combinations and special cash pooling solutions exist on the market. For example pooling can comprehend not only one but more currencies (multi-currency pooling) it can be based on cross border transactions (cross border cash pool) or on combined solutions. For detailed descriptions of the special products see Walter-Kenesei (2015).

Finally, banks do not necessarily transfer money – effectively or virtually – from one account to the other to assist the centralized cash management of a company. Sometimes the collection and the processing of information can also create a value added. The so called “information management” or “information pooling” service comprehends only the collection and the provision of the data on the accounts of the participating firms in a structured and processed form.

3. Benefits and costs of cash pooling

Beside technical description, also companies’ benefits and costs of cash pooling are listed and discussed in the literature (see e.g. Rebel, 2007).

The most important source of benefits is the *interest saving*. If some of the pool accounts are in negative while others show positive balances, then the positive accounts finance the negative ones, and hence, the net interest spread can be saved. The second source of benefits arises from the *economy of scale*, as transaction fees and management efforts can be saved and even improvements in banking conditions can be achieved. The third cited benefit is due to the *reduced volatility* of the net accumulated cash flow due to the diversification. As volatility is lower, forecasting errors are also reduced; and it allows companies to release the surplus liquidity permanently from their working capital. The modelling of the cash flows and the discussion of the reduced volatility appear in several papers (Hong-Wannfors, 2007; Dinu, 2010). Finally, we complete the list with a special source of benefits, which is not mentioned in the relevant literature: the *reduced counterparty risk*, which is also a result of the lower net

account position. From this aspect the potential exposure of the firms to the default of the bank is also reduced.

Beside benefits, additional costs of cash-pooling should also be considered. External costs among others include the *direct installation costs* of the new banking service. Account maintenance and reporting requirements also imply expenses from the company's side. In case of cross-border, multicurrency cash pools special regulatory and tax issues may arise, which implies further *advisory and legal expenses*. There are also some *internal costs* to consider: for example costs of internal reporting, allocation of capacity on checking and monitoring banking calculations and handling the documentation. Finally, we should not forget about the potential negative effects of organizational conflicts and resistance, which might appear during and after the implementation.

In this paper we analyze and model the most important elements of and motivations behind cash pooling: the interest savings and the reduced counterparty risk; and compare these benefits to the direct installation costs.

4. Model and simulation

The net cash-flow of two uniform firms is supposed to come from a normal distribution, $N(\mu, \sigma, \rho)$, each day, where μ is the mean, σ is the standard deviation and ρ is the linear correlation between the two stochastic variables. For the sake of simplicity, all these parameters are assumed to be fixed over time. Hence, the net cash account position of firm i ($i=1, 2$) on day t , $X_t^i \in \mathcal{R}$ which equals the cumulated net cash-flows in the period of $[0, t]$ follows an Arithmetic Brown motion (ABM). If the net account position is positive, then it is a deposit (D); and if it is negative, then it is a credit (C):

$$(X_t^i)^+ = D_t^i \tag{1}$$

$$|(X_t^i)^-| = C_t^i \tag{2}$$

Let us integrate these two uniform firms into a cash-pool. If their original positions were of opposite sign, then these positions offset each other and the aggregate deposit and credit is reduced accordingly. Otherwise, if the original positions' signs were the same or at least one of them was zero, then the aggregate position is the sum of the original ones, and there is no reduction in the overall deposit or credit, see Table 1.

Table 1: Illustration of the netting of the cash account positions

	X_t^1	X_t^2	$X_t = X_t^1 + X_t^2$	Reduction in the deposit
1	+15	-5	+10	+5
2	+3	-8	-5	+3
3	+4	+2	+6	0
4	-5	-1	+6	0
5	0	+7	+7	0
6	-9	0	-9	0

Source: the authors

As Table 1 shows, the reduction in the aggregate deposit, ΔD_t is always positive or zero.

$$\Delta D_t = (D_t^1 + D_t^2) - D_t^{1+2} \geq 0 \quad (3)$$

The same is true for the reduction in the aggregate credit, ΔC_t , as well:

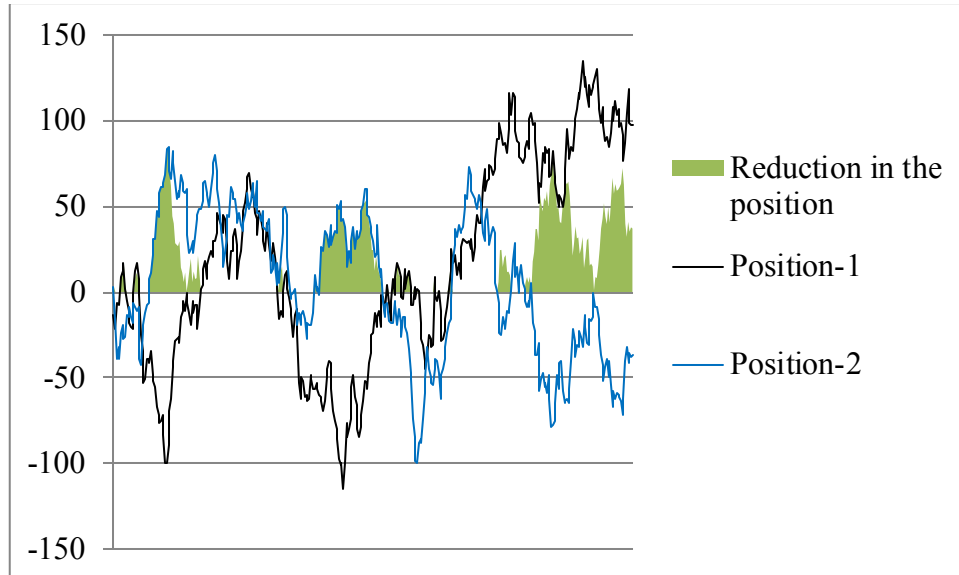
$$\Delta C_t = (C_t^1 + C_t^2) - C_t^{1+2} \geq 0 \quad (4)$$

It is obvious that the reduction in the deposit just equals the reduction in the credit. Let us call this amount as the *reduction in the position*, ΔX_t :

$$\Delta C_t = \Delta D_t = \Delta X_t \quad (5)$$

Figure 1 illustrates how ΔX_t may evolve over time if the initial account position in $t=0$ is zero.

Figure 1: Illustration of the reduction in the account position due to cash-pooling over one year (a hypothetic random scenario)



Source: the authors

Let us denote the interest rate on the credit with c , and the interest rate on the deposit with d . The benefit of the cash-pool, B_t , comes from two sources. Firstly, the firms benefit from the

reduction of the position because of the net interest spread ($c-d$), as the interest rate on the credit is higher than the interest rate on the deposit. Secondly, due the reduced position the firms have a lower counterparty risk exposure to the bank, as well. Let us denote the probability of default of the bank with p . In case of default, the loss is assumed to be 100% (loss given default = LGD = 100%). For the sake of simplicity, c , d and p are all supposed to be fixed and are expressed on a daily basis. Therefore, the benefit of the firms coming from the cash-pooling at a given day is:

$$B_t = c\Delta C_t - d\Delta D_t + p\Delta D_t \quad (6)$$

Using (5), (6) and the notation of $s = c - d > 0$ (interest spread) we get

$$B_t = (s + p)\Delta X_t \quad (7)$$

where only ΔX_t is stochastic. The *total benefit realized over one year* (B) can be calculated by simply adding up the daily benefits, provided that we disregard the compounding of the interests within a year, which is a common practice in the management of the bank accounts.

$$B = (s + p) \sum_{t=1}^{365} \Delta X_t = (s + p)X \quad (8)$$

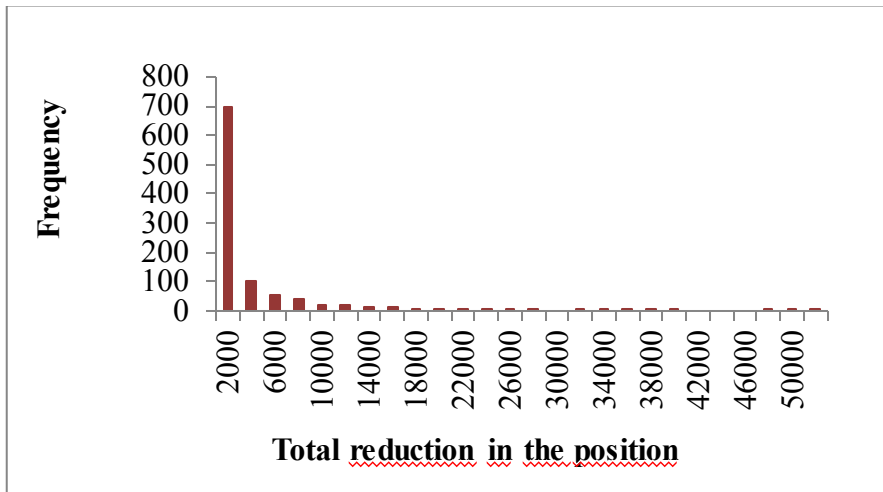
where X is the *total reduction in the position over one year*. In order to evaluate the ex-ante benefits coming from a two-element cash-pool during one year, we have to calculate the expected value of B which is

$$E(B) = (s + p)E(X) \quad (9)$$

Therefore, the key element of the valuation is the calculation of the expected total reduction in the position $E(X)$. One possible way of the calculation is for example, the use of a Monte Carlo simulation as follows.

The individual accounts of two uniform firms were supposed to follow Arithmetic Brown motion. We defined the *base case* as a scenario of $\mu = 1$, $\sigma = 10$ and $\rho = 0$. We conducted a Monte Carlo simulation for a period of one year where the number of repetitions was 10 000. For each repetition we calculated the sum of daily reductions in the position (X) which turned out to follow a highly asymmetric distribution shown on Figure 2.

Figure 2: The distribution of the total reduction in the position over one year (X) in the base case

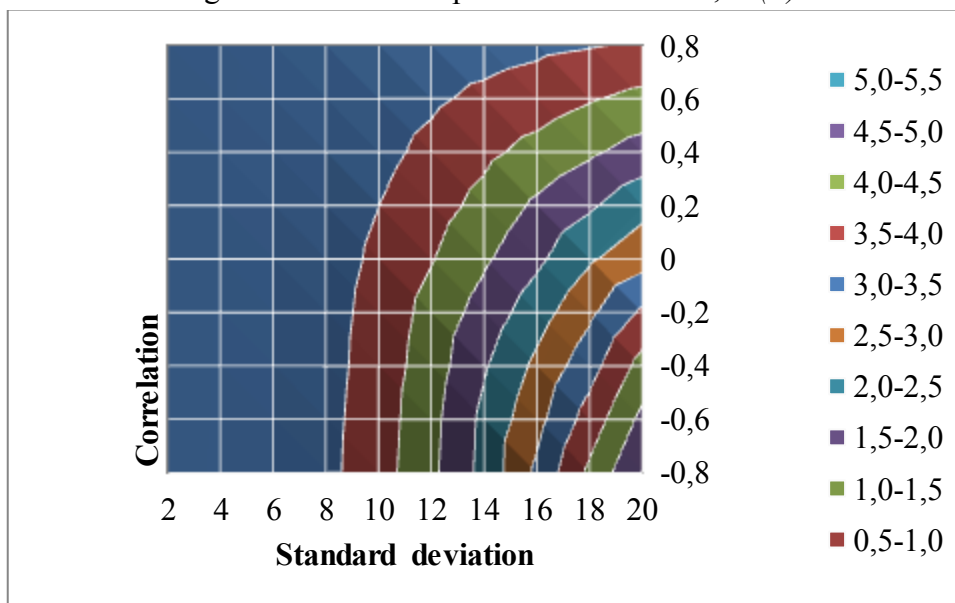


Source: the authors

In the base case the expected value of X was around 3000. If the yearly net interest spread is 3% and the yearly probability of default is also 3% (this corresponds to a rating category of “non-investment grade”), then $s + p = 0.017\%$. In this case, the expected benefit of one year operation is around $B = 3000 \cdot 0.017\% = 0.5$ which equals approximately half of the daily net cash income of one firm.

Simulation shows that this benefit depends more on the standard deviation (σ) and on the correlation (ρ) than on the expected value of the daily cash inflow (μ). Therefore, we performed a sensitivity analysis on σ and ρ . Figure 3 presents the contour-map of the bivariate benefit function:

Figure 3: Contour-map of benefit function, $E(X)$



Source: the authors

The benefit is increasing in the standard deviation and is decreasing in the correlation, as expected. It follows that cash-pooling is more valuable for more volatile and diverse firms. The correlation has a natural lower limit of -1 (in principle this would give the maximal cash-pool value), but this lower limit is unrealistic to be approached in normal business conditions. However, standard deviation is not limited and the value of the cash-pool is very sensitive to this parameter.

5. Results

According to (9) the benefits of the cash-pool over a year can be calculated as $(s + p)E(X)$ where s is the net interest spread and p is the probability of default of the bank (both s and p are fixed and expressed on daily basis), whereas $E(X)$ is the expected value of the reduction in the net cash account position of the firms participating in the pool sum up over the whole year which is the sum of the green area on Figure 1.

To get a general impression whether a cash pool implementation is really worth for a company first the base case is discussed. In the base case ($\mu = 1$, $\sigma = 10$ and $\rho = 0$) the benefits of the cash-pool were around 0.5 day's expected income of one firm. Given that experts estimations set the direct initial costs of a simple cash-pool implementation at around 5000 euro, one year benefits cover the initial costs only for those firms which have a daily expected net cash-flow higher than 10 000 euro, that is more than 3,65 M euro per year. In this calculation we are referring to the net cash-flow (incomes-costs), which is a proxy for the net profit. Supposing that the profit margin is around 10%, the payback period will remain under 1 year, only if the net sales of a firm are over 36.5 M euro. As firms with a net cash-flow under 50 M euro per year are considered as small or medium enterprises (SMEs), we can conclude that the implementation of a cash-pool system can be a highly profitable project even for SMEs. Moreover, we can see on Figure 3 that if the volatility of the cash-flow increases, the value of the cash-pool increases sharply. For example, if we double the volatility from 10 to 20, then the cash-pool becomes six times more valuable (around 3 days of the expected daily net cash-flow). Hence, in case of high volatility even smaller firms (around net sales of 10 M euro per year) may profit from cash-pooling.

The application of the valuation formula $(s + p)E(X)$ in a real business situation may seem quite simple for the first sight as the interest rate spread (s) and the probability of default of the bank (p) are relatively easy to estimate. Standard spreads are posted on the bank's webpages (non-standard firms can get special offers from the bank); in the developed financial markets it is ranging between 0.5%-6% with an average of 3%, (Worldbank Databank 2015). The probability of default of a given bank can be estimated from the rating of the bank, or from the bond prices issued by the bank or from the corresponding CDS spreads. Default rates in the banking sector are usually somewhere between 0%-4%, as it can be seen from the data of the rating agencies (Standard and Poors 2014).

According to the empirical literature interest rate spreads depend mostly on the market, the regulatory environment, the market structure and the riskiness of the bank's portfolio.⁶ Due to this latter component, there is a strong positive connection between the interest rate spread (s) and the probability of default (p) of a given bank, meaning, that big, stable banks with high ranking usually operate with higher interest rate spread (Ho and Saunders 1981, Wong 1997, Saunders and Schumacher 2000, Pasiouras et. al 2007, Ionnidis et al. 2010, Tan 2012).

Once we have estimation for s and p , which are the parameters reflecting the bank's position, we have to determine the expected reduction in the exposure over one year $E(X)$, which is characterizing the firms' side, as it depends on the cash holding of the firms: its timing, magnitude, volatility and the correlation between them. This is the most difficult part of the valuation process, as the expected reduction in the exposure cannot be calculated intuitively. This is why one has to turn to some simulation technics, as it was presented in this paper. We know from the financial literature that corporate cash holdings depend mostly on the growth opportunities (+), the volatility of the cash-flow (+), and the access to the capital market (-). Due to this latter factor large firms with high credit ratings can afford to keep lower cash. Other, but less relevant determining factors can be the ownership structure, the liquidity of the assets⁷, the leverage, the bank debt etc. (Oplet et al. 1999; Ozkan and Ozkan 2004).

To sum it up, cash-pooling is more beneficial for heterogeneous and rather negatively correlated firms with large and volatile cash-flows. Large corporate cash holding can be due to significant and unforecastable growth opportunities, high volatility of the corporate cash-flows and to less accessible capital markets (for example because of the low credit rating or the underdevelopment of the capital market). On the other hand, interest rate spreads and the counterparty risk of the bank are also important factors which may show high variability across countries and over time, but can be easily estimated in a given situation. Hence, cash-pooling creates more value in case of using the services of small and risky banks, because the interest spread and the probability of default are in strong positive relationship and both increase the value of the cash-pool.

⁶ We must note that most of the empirical articles deal with the interest rate margin, which is closely correlated to the interest rate spread.

⁷ For measuring the liquidity of the assets see: Gyarmati et al. (2010).

6. Conclusion

We analyzed a special corporate banking product, the so called cash-pool, which gained remarkable popularity in the recent years as firms try to manage their liquidity more efficiently. We formulated a valuation model and applied a Monte Carlo simulation to assess the two most important benefits arising from a cash-pool: the interest rate savings and the reduction in the counterparty risk. We conclude that the value of a cash-pool is higher in case of firms with large, diverse and volatile cash-flows having less access to the capital markets especially if the partner bank is also risky and offers a high interest spread. It is also shown that cash-pooling is not the privilege of large multinational firms any more as the initial direct costs can be easily regained within a year even in the case of SMEs, especially if the corporate cash holding is highly volatile.

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