working paper

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PSAF, Economic Capital and the New Basel Accord

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The 1980 Monetary Control Act requires the Reserve Banks to recover their costs of providing payments services over time, including a normal return on capital – that is, the same after tax return on equity that a private firm would require. To date, this private sector adjustment factor has been estimated and applied as a single hurdle rate for all Reserve Bank payments services. Capital budgeting theory suggests that firms should use a different hurdle rate for each distinct type of activity according to its risks. For Reserve Bank payments services, this might entail estimating separate private sector adjustment factors for paper-based services and for electronic services. Alternatively, a single hurdle rate of capital could be used for all services if capital is allocated to each service according to its risk.

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The 1980 Monetary Control Act changed the competitive environment for payments services providers. This landmark legislation sought to level the playing field between the Federal Reserve Banks and private providers of correspondent banking services in two ways. First, it provided all depository institutions with equal access to the services offered by Federal Reserve Banks. Second, in the absence of an overriding social welfare concern, the MCA required the Reserve Banks to recover their costs of providing payments services over time, including a normal return on capital – that is, the same after tax return on equity that a private firm would require.[1]

As embodied in the Federal Reserve System payments services White Paper, the historical approach to complying with the MCA has been the construction of the private sector adjustment factor (PSAF) as a proxy for the differential costs Reserve Banks would incur if they were truly private providers of correspondent banking services.[2] Properly constructed, the PSAF would improve the economic efficiency of the market for correspondent banking services by minimizing one of the artificial competitive advantages associated with the GSE status of Reserve Bank payments services.[3]

Unfortunately, there are a number of reasons to believe that the current method for computing the PSAF results in an estimated cost of capital that is not representative of the private cost of capital associated with the types of correspondent banking services provided by the Reserve Banks.[4] As we will discuss later, whether or not the return on equity for the top 50 bank holding companies (or top 50 financial holding companies) was ever a valid proxy for the hurdle rate of capital for Federal Reserve payments services, there is a reasonable presumption that this index is an increasingly poor proxy for the Fed payment services' hurdle rate of capital.[5] This is especially true given the

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[1] Federal Reserve payments services is one of the few government-sponsored enterprises that Congress has explicitly sought to negate the competitive advantages associated with GSE status – the other exception is Sallie Mae who is in the process of full privatization (see Sallie Mae [1996]).

[2] See Federal Reserve Board (1984).

[3] Reserve Bank Correspondent Banking Services still enjoy a number of competitive advantages from being housed in the nation's central bank including access to: irrevocable payments guarantees, universal settlement, and universal lender-of-last resort facilities.

[4] The cost of equity capital component of the PSAF is computed at the 5 year moving average of the book equity returns for the top 50 bank holding companies. A simple description of the PSAF calculation and some proposed refinements can be found in Green et al. (2001a, 2001b).

[5] Issues with respect to the computation of PSAF and proposed reforms are discussed in Green et al. (2001).

withdrawal of many large banks from correspondent banking services and the increased diversity of activities that can be (and are being) conducted under the financial holding company umbrella raised by the Financial Services Modernization Act of 1999.

A separate issue arises in the allocation of capital to different types of payments services. Capital budgeting theory suggests that firms should use a different hurdle rate for each distinct type of activity according to its risks. In the case of Reserve Bank correspondent services, this might entail estimating separate PSAFs for paper-based services and for electronic services. Alternatively, a single hurdle rate of capital could be used for all services if capital is allocated to each service according to its risk. This is the rationale behind the use of RAROC (risk-adjusted return on capital) in bank lending decisions and the spirit behind the Federal Reserve's SR99-18 economic capital directive. Furthermore, the recently announced Basel capital accords should require the Federal Reserve to fundamentally rethink its approach for assigning capital to its payments services.

I. Impediments to PSAF Reform

Unlike private providers of correspondent banking services, Reserve Bank cost of capital computations are subject to the approval of their primary regulator – the Federal Reserve Board – and the scrutiny of politicians. Subjecting the method for computing the PSAF to public examination and debate is important because, as the nation's central bank, the Federal Reserve is not subject to the varieties of market discipline faced by its private payments system competitors. While a quasi-private board of directors oversees the operations of each Federal Reserve Bank's payments operations, Reserve Banks are not subject to the market for corporate control. This is due, in part, to the nontransferability of Federal Reserve Bank stock and to the ability of Reserve Banks to fund their operations out of the seigniorage revenues earned from issuing the monetary base.

Unfortunately, conducting PSAF reform in the public arena has been a major obstacle towards making needed changes to more fully comply with the Board of Governor's regulatory implementation of the MCA. Prior to the passage of the Financial Modernization Act of 1999 only material changes in the computation of the PSAF were

subject to the public comment – through the publication of these changes in the Federal Register for public comment. This lack of periodic review of the existing method for computing the PSAF reinforced the inertia of the status quo.

Green et al. (2001b) note that the computation of the PSAF must "Be intelligible and justifiable to the public, and replicable from information that can be obtained by the public." In other words, the public nature of Reserve Banks places the additional burden of simplicity and understandability on any method adopted to compute the RBCBS' hurdle rate(s). While the method adopted to compute the PSAF must be straightforward and defensible, transparency need not come at the expense of accuracy. Unfortunately, the sometimes politically charged atmosphere in which PSAF reforms are made may result in a level of simplicity in the construction of the PSAF that does not increase its transparency, but does reduce its usefulness as a proxy for the required private rate of return on capital for correspondent banking services. Moreover, misapplication of the simplicity criteria increases the cost of innovation and hence, biases the process against the introduction of meaningful reforms.

II. An Economic Capital Approach to Capital Budgeting

In 1994 Bankers Trust introduced 'risk adjusted return on capital' (RAROC). Under the RAROC approach decisions are made using the firm's weighted-average cost of capital as the hurdle rate for investment decisions. RAROC controls for differences in risk across projects/investments thorough a decision rule that allocates capital to projects/investments according to their risk. For example, a $100 million loan to a AAA-rated borrower would be allocated less capital than a similar loan to BBB-rated credit. Ultimately, the decision to make either loan will hinge upon whether the rate of return on capital exceeds the hurdle rate (cost of capital). [6]

To illustrate the use of RAROC, consider the following example. Assume that a firm is interested in investing for one period and it has three alternative investments (A, B

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[6] RAROC = $E(Y)/K^*$, where $E(Y)$ = one period expected income on the investment and K^* is the amount of capital at risk. We want to take on all investments/projects for which RAROC > RAROC*, where RAROC* is the bank's hurdle rate or weighted-average cost of funds (including capital). Here a period is effectively the amount of time before investments can be redeployed.

and C) to consider. Assume that the firm's cost of equity capital, RAROC*, is 8.5 percent and it will take on any investment where

$$E(Y)/K \geq RAROC^* = 0.085.$$

Here E(Y) is the one-period expected income from the investment and K is the amount of capital allocated to the investment (that is, E(Y)/K = expected return on equity). Furthermore, assume the one-period expected income accruing to the firm's equity holders on each investment is A ($90), B ($85), and C ($80). Finally, assume that each investment will cost $10,000 and that the firm uses its capital-to-asset ratio of 10 percent to allocate capital to its investments – hence, the capital charge for each investment is $1000. Table 1 presents the firm's investment decision.

Table 1: Capital Allocated by Capital-to-Asset Ratio

Investment	ROE	Take	RAROC*	E(Y)	K
A	0.0900	Yes	0.085	90	1000
B	0.0850	Yes	0.085	85	1000
C	0.0800	No	0.085	80	1000

Under the simple capital rule, the firm will take on investments A and B. However, what the simple capital rule does not account for is that the three investments pose different risks to the firm. By construction the investments each carry a different level of risk and we assume that the law of one price holds – hence, A is the riskiest investment and C is the safest. Investment A is riskier than the firm's current assets. Investment B carries the same level of risk as the firm's current assets. Finally, the risk of investment C is less than that of the firm's assets. Hence, allocating capital to new investments according to the firm's existing capital structure biases the firm towards investments like A (ones riskier than average for the firm) and away from investments like C (ones less risky than average for the firm).

Table 2 shows the investment decision under RAROC where capital is allocated to the alternative investments according to their risk – that is according to the amount of the firm's capital that is exposed by the investment. In table 2, K* corresponds to the amount of capital at risk for each alternative investment and RAROC is E(Y)/K*.

Table 2: Capital Allocated by Risk Exposure

Investment	RAROC	Take	RAROC*	E(Y)	K*
A	0.0833	No	0.085	90	1080.000
B	0.0850	Yes	0.085	85	1000.000
C	0.0870	Yes	0.085	80	920.000

Under the RAROC rule, we would still take on investment B. However, once risk is taken into account (under RAROC this is done by adjusting the amount of capital allocated) the firm would no longer consider investment A but would take on C. In fact, investment C adds the most value to the firm because its risk-adjusted return exceeds the firm's cost of capital. By not taking into account risk, the simple investment rule reduces firm value because its risk-adjusted return is less than the firm's cost of capital.

Application to Reserve Bank Correspondent Banking Services (RBCBS)

Currently, the Federal Reserve Banks follow the equivalent of the simple capital allocation rule in the application of PSAF in its pricing decisions. The Federal Reserve Board's White Paper on financial services, the regulatory interpretation and implementation of the MCA, requires the RBCBS to price its products to cover operating costs plus PSAF. While the MCA mandates full cost recovery by RBCBS over the long run, the Federal Reserve Board mandates the more stringent requirement of full cost recovery each year for each broad service line. There are a number of reasons to question whether the PSAF, as currently computed, properly measures the private cost of capital for RBCBS.

Electronic payments services and paper-based payments services are unlikely to have the same risk and hence, even if the PSAF represents the appropriate hurdle rate (cost of capital) for RBCBS it is unlikely to be the appropriate hurdle rate for either type of service. If we assume that the Fed's check service is less risky than its electronic services then the appropriate hurdle rate for paper-based services will be less than the PSAF, and conversely the appropriate hurdle rate for electronic services will be higher than the PSAF. However, the purpose of this example is not to show the defects in the PSAF, but rather how the failure to apply a correctly computed PSAF can lead to distortions in the pricing of RBCBS individual product lines.

Assume that the RBCBS has two distinct product lines (check and wire transfer) over which it must allocate $5 million in capital. In addition, assume that the check service accounts for 80 percent of total RBCBS operating costs and that the Reserve Banks evenly allocate capital on the basis of operating costs. Finally, assume that in the private sector electronic payments services have a higher required rate of return on capital (are riskier) than paper-based payments services.

Table 3: Capital Allocated by Share of Expenses

Service	PSAF	E(Y)*	K
Wire Transfer	0.012	12000	1,000,000
Check	0.012	48000	4,000,000

In table 3, E(Y)* is the earnings that Wire Transfer and Check must produce (in addition to their operating costs) to cover a PSAF of 12 percent, given their capital allocation.

Under a RAROC-like economic capital approach, capital would be allocated according to the riskiness of the activities. This is illustrated in table 4 where wire transfer's economic capital allocation is assumed to be $1.5 million and check's economic capital allocation is assumed to be $3.5 million.

Table 4: Capital Allocated by Share of Expenses

Service	PSAF	E(Y)*	K
Wire Transfer	0.012	18000	1,500,000
Check	0.012	42000	3,500,000

Comparing tables 3 and 4 we see that failure to take into account differences in risk in allocating capital results in Check having to earn an additional $6000 to cover the PSAF – and results in a cross subsidy of the electronic services by the paper-based ones

This example focuses on required earnings to illustrate the biases in simple capital allocation rules on service line prices under a 'full cost recovery by product line' mandate. The extension of this example to examine investment/capital-budgeting decisions is trivial, a simple replication of the RAROC example in tables 1 and 2 and hence, won't be presented here. However as in the investment example above, the failure to either charge different hurdle rates for each service (given a non-risk-based capital allocation) or allocate economic capital according to risk (when a single hurdle rate is

used) can lead to suboptimal investment/capital budgeting decisions – ones that can destroy economic value.

Basel II and RBCBS Capital Allocation

In June of 1999 the Basel Committee on Banking Supervision released the consultative paper "A New Capital Adequacy Framework." This paper was followed by release of the full proposal for comment in January of 2001.[7] Basel II represents a major change in the approach to capital regulation, one that has implications for RBCBS. Under the traditional approach to capital adequacy as embodied in the 1988 Basel Capital Accords, a bank's regulatory capital was determined by the broad set of activities it engaged in. These activities were assigned to crude risk buckets to determine regulatory capital. Under the new Basel capital adequacy framework, capital will be assessed according to the risks a bank undertakes. Banks – in particular internationally active institutions or large complex banking organizations – will be required to assign capital according to three types of risk: credit risk, market risk, and operations risk. Banks will be expected to comply with a fully implemented standard in 2005.

Following the first Basel II consultative paper, the Federal Reserve issued a supervisory letter on economic capital allocation. Generally referred to as SR 99-18, this supervisory letter "…directs supervisors and examiners to evaluate internal capital management processes to judge whether they meaningfully tie the identification, monitoring, and evaluation of risk to the determination of the institution's capital needs."[8] In general, SR 99-18 can viewed as part of the shift in capital regulation from activity based capital adequacy standards towards risk-driven capital standards.

From the perspective of RBCBS, Basel II and SR 99-18 present a new challenge. Under current interpretation and regulatory implementation of the MCA by the Board of Governors, RBCBS will need to develop the capability to allocate capital to its services according to their risks in a manner that is consistent with Basel II and that meets the

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[7] Information on the New Basel Capital Accord, including the second consultative package and comments received, can be found at http://www.bis.org/publ/bcbsca.htm.
[8] See Federal Reserve Board (1999).

standards set out in SR 99-18.[9] Conceptually, economic capital allocation in the spirit of Basel II and SR 99-18 is the same approach outlined earlier in this section – that is, the assigning of capital to payments services by their risks. This is why we advocate this approach over the multiple-hurdle rate approach for RBCBS pricing and capital budgeting decisions outlined below.

III. Different Strokes for Different Folks: Service Specific PSAFs

An alternative to adjusting the capital allocation to account for risk is to adjust the hurdle rate – or rather estimate the cost of capital by service line.[10] Following the examples in the previous section assume RBCBS has two service lines – wire transfer and check. The weighted-average cost of capital (PSAF) has two components, the private cost of capital for a check clearing service ($PSAF_{CK}$) and the private cost of capital for a wire transfer service ($PSAF_{WT}$).

$$PSAF = wPSAF_{CK} + (1-w)PSAF_{WT} \qquad (1)$$

The w in equation (1) is the proportion of total payments services activities accounted for by the check service line – measured as the proportion of RBCBS costs allocated to check. Clearly, the true cost of capital for RBCBS is a function of the private cost of capital for each service line and their relative weights. From equation (1) the PSAF will vary through time as the mix of RBCBS payments services changes – irrespective of whether the private hurdle rates for check and wire transfer change.[11]

Implications for Capital Budgeting

From a capital budgeting perspective, if $PSAF_{CK} \neq PSAF_{WT}$ then use of PSAF as the hurdle rate of capital for either service will lead to suboptimal investments. To illustrate this, assume that $w = 0.8$, $PSAF_{CK} = 0.1$, $PSAF_{WT} = 0.15$ and $PSAF = 0.11$.

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[9] SR 99-18 outlines what it calls the "the fundamental elements of a sound internal capital adequacy analysis" which includes "– identifying and measuring all material risks, relating capital to the level of risk, stating explicit capital adequacy goals with respect to risk, and assessing conformity to the institution's stated objectives - as well as the key areas of risk to be encompassed by such analysis."

[10] Kane (1999) advocates this approach.

[11] Equation (1) also provides intuition on the inadequacy of using the top 50 bank or financial holding company equity returns to compute the PSAF. For these large financial companies the cost of capital is the weighted average of a diverse set of activities whose risks and required returns are unrelated to the correspondent banking services offered by RBCBS

Assume that RBCBS has the following projects available to it; each project costs $1000 and has net cash flows C(1) to C(5) over the next five periods. Under the net present value (NPV) rule the RBCBS check business should undertake all projects whose NPV $\geq$ 0 and reject all negative NPV projects.

Table 5

				Cash Flows			
Project	Type	C(0)	C(1)	C(2)	C(3)	C(4)	C(5)
A	Check	-1000	700	300	50	50	50
B	Check	-1000	100	100	100	600	600
C	Check	-1000	275	275	275	275	275
D	Check	-1000	100	150	150	150	1000
E	Wire Transfer	-1000	100	200	300	400	400
F	Wire Transfer	-1000	100	100	100	700	700
G	Wire Transfer	-1000	300	300	300	300	300
H	Wire Transfer	-1000	900	100	100	100	100

Assume that RBCBS looks at the four check projects in table 5. Table 6 shows the results of the capital budgeting decisions for these check projects using the RBCBS single hurdle rate (PSAF) and the appropriate hurdle rate for check projects. Using PSAF as the discount factor (hurdle rate) we reject projects A and B under the net present value rule. Using the appropriate hurdle rate to evaluate the projects, project A is still rejected (NPV$_A$ = -12.94). However, RBCBS would take on project B, which has an economic value added (EVA) of 31.05.

Table 6: Capital Budgeting in Check

	PSAF = 0.11		PSAF$_{CK}$ = 0.10		
Project	Take	NPV	Take	NPV	EVA Lost
A	No	-26.71	Yes	-12.94	0
B	No	-4.32	Yes	31.05	31.05
C	Yes	16.37	Yes	42.47	0
D	Yes	13.77	Yes	50.95	0

A second way to examine the distortions in investment decisions is to consider an alternative investment rule. Assume that RBCBS can only take on one project and therefore, its optimal decision rule is to undertake the project with the highest NPV. Using the correct hurdle rate – PSAF$_{CK}$ – project D would be selected. However, employing the single hurdle rate – PSAF – in the decision results in the RBCBS incorrectly choosing project C over project D – the EVA lost is $8.48.

Table 7 shows the distortions to the capital budgeting decision when the PSAF is used as the hurdle rate for projects whose true cost of capital is higher than the average cost of capital. Using the PSAF of 11 percent RBCBS would take on projects F, G and H. However, using the correct hurdle rate for wire transfer projects – $PSAF_{WT}$ – of 15 percent project F would be rejected because it has a negative NPV (-23.43). In other words, taking on F destroys economic value because it returns less than the cost of capital.

Table 7: Capital Budgeting in Wire Transfer

	PSAF = 0.11		$PSAF_{WT}$ = 0.15		
Project	Take	NPV	Take	NPV	EVA Lost
E	No	-27.36	No	-136.99	0
F	Yes	120.90	No	-23.43	-23.43
G	Yes	108.77	Yes	5.65	0
H	Yes	90.31	Yes	30.87	0

Following the example for check, assume that RBCBS can only select one wire transfer project. In this scenario, RBCBS should rank the projects according to their NPV and select the project with the highest NPV. When the average cost of capital is used to compute the NPV, the highest valued project would be F – with an estimated value of $120.90 and a true value of -$23.43. On the other hand, when the $PSAF_{WT}$ is used to compute NPV the highest value project is H. Hence, economic value is destroyed by the simple application of PSAF.

Finally, table 8 shows the project rankings for RBCBS for all projects A through H using PSAF and using the appropriate hurdle rates ($PSAF_{CK}$ and $PSAF_{WT}$) for check and wire transfer projects. Two things stand out in table 8. First, if we cannot do all positive NPV projects – due to funding, regulatory or political constraints – the use of PSAF causes overinvestment in the riskier projects at the expense of the higher economic value added projects. Second, using PSAF as the hurdle rate would have resulted in RBCBS undertaking at least one negative NPV project (from tables 6 and 7 we know that A, F, and E have negative NPVs).

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Table 8: RBCBS Project Rankings

Average Hurdle Rate		Correct Hurdle Rate	
Project	Type	Project	Type
F	Wire Transfer	D	Check
G	Wire Transfer	C	Check
H	Wire Transfer	B	Check
C	Check	H	Wire Transfer
D	Check	G	Wire Transfer
B	Check	A	Check
A	Check	F	Wire Transfer
E	Wire Transfer	E	Wire Transfer

Implications for Cost Recovery

As noted earlier, under current regulatory interpretation of the MCA 1980, RBCBS are required to recover their operating costs and normal private return on capital. The use of the average cost of capital (or the proxy thereof) for all service lines can distort pricing decisions by the product lines. Assume as in section II that the RBCBS has two distinct product lines (check and wire transfer) over which it must allocate $5 million in capital. In addition, assume that the check service accounts for 80 percent of total RBCBS operating costs and that the Reserve Banks evenly allocate capital on the basis of operating costs. Finally, assume that the hurdle rates for check and wire transfer are $PSAF_{CK} = 0.1$ and $PSAF_{WT} = 0.15$ (which gives a weighted-average cost of capital and PSAF of 0.11). Table 9 shows the expected earnings, $E(Y)^*$, that wire transfer and check must earn to return PSAF given the capital allocation, K.

Table 9: Using Average Cost of Capital

Service	PSAF	$E(Y)^*$	K
Wire Transfer	0.011	11000	1,000,000
Check	0.011	44000	4,000,000

Table 10 shows the required expected earnings that check and wire transfer would need to produce if the true hurdle rates ($PSAF_{CK}$ and $PSAF_{WT}$) for each product line are used.

Table 10: Cost of Capital by Service Line

Service	$PSAF_{XX}$	E(Y)*	K
Wire Transfer	0.015	15000	1,000,000
Check	0.010	40000	4,000,000

A comparison of tables 9 and 10 shows the following. First, the total earnings needed to cover the cost of capital at the corporate level is $5500 in both tables. Second, the average return on capital for RBCBS is unchanged by the use of PSAF or the product line hurdle rates. Finally, the failure to use the appropriate hurdle rate rates for each service line results in a cross subsidy of wire transfer by check to the tune of $4000 (or 4 percent return on capital).

IV. Where Do We Go From Here?

The analysis in this paper illustrates how a failure to account for differences in risk across correspondent banking service lines leads to distortions in investment and pricing decisions. These distortions result in the loss of economic value arising from suboptimal investment decisions and a cross subsidy from low risk product lines to high risk ones. Our examples show that such distortions would arise even when the PSAF – the proxy for the average cost of capital – is computed correctly. Moreover, a PSAF that is a poor measure of the required private rate of return on correspondent banking services will likely increase any social welfare losses associated with current RBCBS capital allocation and pricing rules.

Fundamental PSAF reform requires future work in two areas. First, there is a need to assess the risks of current and proposed services to arrive at an economic capital allocation rule. Second, there is a need to arrive at a defensible and economically sound method for computing PSAF. Construction of a better proxy for the private return on capital associated with correspondent banking services is critical – irrespective of whether a single hurdle rate (with risk-based capital allocations) or multiple hurdle rate approach to capital budgeting and product pricing is employed. Moreover, the inadequacy of the current approach and hence, the need for fundamental reforms has been

accentuated by the passage of the Gramm-Leach-Bliley Act of 1999 and the new Basel Capital Accords of 2001.

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