COMPLEMENTARITIES BETWEEN LOAN SALES AND STANDBY LETTERS OF CREDIT: A THEORETICAL MODEL

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Abstract

In their traditional function, commercial banks engage in recourse loan sales while evaluating clients' creditworthiness and assuming risk. However, banks face regulatory constraints that prevent them from fully exploiting this activity. Loan sales with recourse are treated as deposits, and selling banks are required to hold additional reserves at the Fed; they are also subjected to higher capital requirements and must make additional FDIC deposit insurance premiums. By contrast, standby letters of credit and loan sales without recourse are considered off-balance-sheet items and are not subject to the aforementioned regulatory requirements. This paper uses the time-state preference model to demonstrate that the cash flow structures of recourse loan sales can be replicated by constructing portfolios consisting of non-recourse loan sales and standby letters of credit. Our theoretical model contributes to the existing literature by illustrating how banks can combine loan sales without recourse with standby letters of credit as complementary risk-management and cost-reduction instruments.

Keywords: cash flow structures, credit risk transfer, financial intermediation, off-balance sheet activities, regulatory costs

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1. Introduction

In the last three decades, commercial loan sales have experienced an unprecedented expansion. The rapid expansion of commercial loan sales and standby letters of credit (SLCs) has raised a key question with regard to the changing nature of traditional banking and financial intermediation. Indeed, as later discussed in this paper, commercial loan sales with recourse are considered instruments of traditional banking, since banks not only perform the credit analysis but also undertake the risk of lending. However, closer examination of commercial loan sales data in the U.S. reveals that a significant portion consists of loan sales without recourse. This transforms the originating banks into simple loan brokers, and as such, it is evident that they deviate from their traditional role.

This paper draws on research conducted by Gargalas (2007) and explores this issue by modelling the relationship between two of the most prevalent off-balance sheet (OBS) instruments in the U.S banking sector: (1) commercial loan sales and (2) SLCs. Our theoretical model demonstrates that banks can eliminate regulatory taxes by creating synthetic loan sales with recourse by combining portfolios of commercial loan sales without recourse with portfolios of SLCs. As a result, bank loan sales activities remain within the scope of their traditional loans and functions.

This has several implications for banks participating in the commercial loan sales market. First, once the aforementioned relationship is clearly established, bank managers can actually focus on implementing the strategy of creating synthetic loan sales with recourse as described by our model, instead of allowing it to emerge passively. Second, while participating in this strategy (or process), banks will become more efficient and will be better able to adapt to a rapidly evolving financial environment.

The paper is organised as follows. Section 1 presents this Introduction. Section 2 reviews recent literature on the principal motivations for commercial loan sales and provides a brief overview of SLCs. Section 3 discusses the theoretical model we developed to analyse the relationship between commercial bank loan sales and SLCs. Finally, Section 4 presents the conclusions of our study.

2. Literature Review

The first type of OBS activities included in our model are commercial loan sales by banks (or depository institutions). In a commercial loan sale, the originating bank sells a loan “in totality” or “in part" (Irani & Meisenzahl, 2017; James, 1988; Siedlarek & Yankov, 2025). In the case of loan sales “in totality,” the buyer buys the entire cash flow (associated with the loan) until the loan matures, while in a participating loan sale, the cash flow from the loan is divided between two or more buyers (Greenbaum et al., 2016; Irani & Meisenzahl, 2017). Commercial loans sold “in part” consist of loan strips and loan participations. Loan strips are short-term shares of long-term loans; upon maturity (e.g., 30 days, 60 days, etc.), the selling bank is required to pay the loan strip holder the contractual amount of the loan, and to refund the originating bank must resell the loan strip for another period or provide direct financing (Greenbaum et al., 2016).[1]

Loan participation consists of a multi-lender financing arrangement that allows the selling (or lead) bank to sell the entire loan to participating banks (Dahiya et al., 2003; Greenbaum et al., 2016). In a loan participation, the lead bank (or seller) negotiates the loan terms with the borrower, directly receives all loan payments from the borrower, and maintains collateral registered in its own name (Dahiya et al., 2003; Greenbaum et al., 2016). In contrast to junior lenders in loan syndication, participants deal only directly with the lead, thereby avoiding the need to have separate contracts with the borrower (Greenbaum et al., 2016).

In a typical commercial loan sale, the originating bank normally continues to service the loan (i.e., monitor borrowers, enforce any existing covenants, and pass the cash flow streams to the buyers) for a fee, which represents a significant source of income from the loan sale (Bord & Santos, 2015; Buchanan, 2016; Dahiya et al., 2003; Greenbaum et al., 2016; Güner, 2006; James, 1988).

Commercial loans may be sold with or without recourse. Commercial loan sales with recourse are originated by the bank and are initially recorded on its balance sheet. Once a buyer (or group of buyers) is found, the loan is sold, and it is removed from the originating

[1] *In 1988, the Financial Accounting Standards Board (FASB) ruled that loan strips can be treated as loan sales if: (a) the buyer of the loan strip assumes full risk, and (b) the lender has no contractual obligation to repurchase the loan strip (Greenbaum et al., 2016).*

bank's balance sheet (Bord & Santos, 2015; Buchanan, 2016; Dahiya et al., 2003; Güner, 2006; James, 1988). If the borrower defaults on the loan, the originating bank is under no obligation to indemnify the buyer (of the loan), thereby transferring credit and default risk to the buyer (Palour & Winton, 2013).

In the case of commercial loans sold with recourse, the selling bank is required to include the loan as part of the assets on its balance sheet to satisfy regulatory capital requirements and subsequently sell them to a third party (Collier, 1994; Drucker & Puri, 2009; Greenbaum et al., 2016; James, 1988). Loan sales with recourse, in essence, leave the originating bank with all, or at least part of the loan's default risk, and such loans must be included in the bank's capital ratios to accurately account for risk (Collier, 1994; Drucker & Puri, 2009; James, 1988). In case of default by the borrower or the deterioration of the quality of the loan, the originating bank is contractually obligated to repurchase the loan from the buyer as specified in the contract between the two parties (Drucker & Puri, 2009).

There are several theories that explain the expansion of commercial loan sales in recent decades. The comparative advantage hypothesis suggests that banks with relatively low capital levels and high funding costs are generally more active in the loan sales market (Demsetz, 2000). The comparative advantage hypothesis suggests that selling banks are those that enjoy a comparative advantage in loan origination and a comparative disadvantage in funding loans (Acharya & Mora, 2015; Pennacchi, 1988). Some banks, particularly larger "money centre" banks, enjoy a comparative advantage in originating loans at lower costs due to their ability to monitor borrowers more efficiently (Fama, 1985; Güner, 2006). They can achieve scale economies in the origination of certain types of loans and can participate in loan sales to fund such loans (Demsetz, 2000). Carlstrom and Samolyk (1995) and Demsetz (2000) found that banks that face capital constraints enjoy a comparative advantage in identifying profitable loans in their areas or regions of operations, and that when they operate in markets with high demand for loans, they tend to have a higher propensity to participate in loan sales. According to the comparative advantage hypothesis, "banks constrained by their funding capacity because of their rich loan-origination opportunities sell loans to those that have relatively cheap funding sources, but poor loan-originating opportunities" (Güner, 2006).

The diversification hypothesis or capital constraints hypothesis offers another explanation for the rapid expansion of commercial loan sales in recent decades. According to this theory, banks that face capital constraints are unable to diversify their sources of funding internally and rely on loan sales to achieve higher levels of diversification. Loan sales provide these banks with alternative (i.e., diversified) funding opportunities, in essence serving as an alternative funding method. Capital-constrained banks facing high loan demand in their respective markets are more likely to participate in loan sales (Becketti & Morris, 1987).

Another reason for loan sales is liquidity (Haubrich & Thomson, 1993; Irani & Meisenzahl, 2017; Pavel & Phillis, 1987). Banks normally use relatively liquid liabilities (e.g., savings accounts and time deposits) to support their illiquid assets (e.g., loans). Banks often pool deposits to provide credit financing, and such pooled deposits generate the scale necessary to support illiquid loans with longer maturities (Irani & Meisenzahl, 2017; Pavel & Phillis, 1987). This increases the amount of liquidity risk in the banking system and overall economy. However, reserve requirements at the Fed, the Central Bank's function as a lender of last resort, participation by depository institutions in the Fed Funds market, and access to the Fed's discount window mitigate the risks associated with holding deposits and provide added liquidity to the banking system (Sarkar, 2009). Banks are able to monitor risks and achieve greater liquidity by selling fee-based services such as monitoring services (Santos and Nigro, 2009; Siedlarek and Yankov, 2025).

The regulatory constraints hypothesis offers another explanation for the notable growth of the commercial loans market in recent decades. This theory suggests that loan sales are a response to reserve and capital requirements (Berger & Udell, 1994; Pavel, 1988; Pavel & Phillis, 1987; Pennachi, 1988; Wall, 1991). Depository institutions are required to hold a portion of their deposits at the Fed in the form of required reserves, which do not generate interest income for the banks (Mishkin, 2021). They are also required to pay a fixed premium based on their total domestic deposits to the Federal Deposit Insurance Corporation (FDIC) (Mishkin, 2021). These regulatory requirements (i.e., holding non-interest-bearing reserves at the Fed and paying deposit insurance premiums to the FDIC increase the opportunity costs of regulatory compliance for the banks, and provide

economic incentives to participate in the commercial loan sales market (Mishkin, 2021).[2]

By participating in loans sales, banks are also able to reduce the regulatory costs of on-balance sheet funding (i.e., minimum reserve requirements, capital adequacy ratios, and the cost of FDIC insurance premiums) (Güner, 2006; McCrary and Outsterhout, 1989; Pavel and Phillis, 1987; Pennachi, 1988; Santos and Nigro, 2009; Wall, 1991). By selling loans and removing such sales from their balance sheets, the selling banks are also able to generate fee income and improve key financial metrics such as Return on Assets (ROA) and Return on Equity (ROE) (Gorton & Haubrich, 1990).[3]

Finally, commercial loan sales can also be explained by the reputational barriers hypothesis. According to Demsetz (2000), the issuance of SLCs enhances the likelihood that a bank participates in the sell side of the loan sales market. A bank's reputation as a well-regarded issuer of SLCs provides an indication of the bank's perceived credit quality (Demsetz, 2000). As Goldberg and Lloyd-Davies (1985) indicate, issuing SLCs has no impact on overall bank riskiness and tends to have a positive impact on the bank's reputation while generally increasing its propensity to participate in the loan sales market.[4]

The second OBS activity examined in our model is SLCs. Letters of credit (LCs) are contractual agreements written by a bank (or "issuer") on behalf of one its customers (or "account party") to make a payment to a third-party beneficiary for goods sold or services rendered by the third-party beneficiary to the bank's client (or account party) (Banks, 1984; Bennett, 1986; FCA, 2008). There are two (2) categories of letters of credit: (1) commercial letters of credit, and (2) SLCs. Commercial letters of credit are short-term credit instruments

[2] During periods of high interest rates, the opportunity cost of holding non-interest reserves at the Fed and making deposit insurance premium payments to the FDIC are higher, providing banks with economic incentives to participate in loan sales (Gryglewicz, Mayer, and Morellec, 2024).

[3] Off-balance sheet financing refers to items that are not normally recorded as assets or liabilities on a company's balance sheet, resulting in contingent claims (or liabilities) against the firm's assets and income. This category normally includes futures contracts, loan commitments, options, securitisation, standby letters of credit, and swaps.

[4] Pavel (1988) investigates loan sales without recourse, the other off-balance sheet instrument included in our analysis, and concludes that they have no impact on overall bank riskiness.

typically used in international trade finance (FCA, 2008). When a bank issues a commercial letter of credit on behalf of a customer, the letter is send directly to the third-party beneficiary; after the bank customer or account party confirms receipt of the goods sold by the third-party beneficiary, the bank sends payment to the third-party beneficiary on behalf of the client or account party (FCA, 2008). The bank retains legal title to the goods shipped by the third-party beneficiary to its client or account party until the customer or account party reimburses the bank (Banks, 1984; Bennett, 1986; FCA, 2008).

In contrast to commercial letters of credit, SLCs represent payment guarantees by the bank or "issuer" to the third-party beneficiary in the event of non-performance or default by its customer (Brewer & Koppenhaver, 1992; FCA, 2008; James, 1988).[5] Typically, a third-party beneficiary presents a standby letter of credit to an issuer (or bank) in the event of non-performance or default by the bank's customer (or account party), thereby creating a primary obligation between the bank (or issuer) and the third-party beneficiary (Banks, 1984). If this payment demand (by the third-party beneficiary) complies with the terms of the standby letter of credit, it must be honoured by the issuer (or bank) (Banks, 1984; James, 1988). As a result, SLCs are riskier than commercial letters of credit, and, as such, they can contribute to increases in liquidity, interest rate, and credit risks for the issuing banks (Bennett, 1986; Brewer & Koppenhaver, 1992).

There are two (2) types of SLCs: (1) performance-based SLCs, and (2) financial SLCs (Bennett, 1986; FCA, 2008): (1) performance-based SLCs, and (2) financial-guarantee SLCs (FCA, 2008). Under a performance-based standby letter of credit, the bank or issuer is obligated to pay a specified amount to the third-party beneficiary in the event of default or non-performance by its customer or account party (Bennett, 1986; FCA, 2008). In the case of a standby letter of credit with a financial guarantee, if the customer or account party defaults on its debt incurred with the third-party beneficiary, the issuing bank is

[5] *Unlike a guarantee, which represents a secondary liability (or obligation) for the guarantor that depends on the non-performance of the underlying contract, in the case of a standby letter of credit the obligation between the issuer and the third-party beneficiary rests on the fact that the issuer is required to honour the third-party beneficiary's demand for payment if it complies with the terms of the letter of credit, independent of the underlying contract (between the account client and the third-party beneficiary) (Banks, 1984).*

required to pay any principal and interest owed by the customer or account party to the third-party beneficiary (Bennett, 1986; FCA, 2008).

Even though OBS activities (e.g., commercial loan sales and SLCs) are excluded from the traditional assets and liabilities categories on bank balance sheets, the regulations established by the Basel Committee on Banking Supervision require banks to hold designated capital reserves against their OBS activities (BIS, 2017). Under Basel II and Basel III regulations, a bank's OBS exposures are multiplied by a credit conversion factor (CCF) to estimate their credit equivalent amount (CEA), thereby converting them into on-balance sheet credit equivalents (BIS, 2017). Next, the on-balance sheet credit equivalent is multiplied by the risk-weighted factor to estimate its risk-adjusted amount (or value) (BIS, 2017). Basel II and III regulations establish a 100% CCF for direct credit substitutes, which includes SLCs (BIS, 2017). However, for performance-based SLCs, which carry lower risk than financial-guarantee SLCs, Basel regulations establish a CCF of 50% (BIS, 2017).

3. Theoretical Model

This section presents the theoretical model, which links SLCs to the two existing types of commercial loan sales: (1) recourse loans and (2) non-recourse loans. Commercial loan sales with recourse expose the bank to credit risk and underwriting risk (Parlour & Winton, 2013). Alternatively, a commercial loan sale without recourse, combined with a simultaneous standby letter of credit on the same loan, exposes the selling bank to underwriting risk arising from the loan sale and to credit risk resulting from the standby letter of credit. Since the underlying loan is the same, both strategies offer the same level of risk exposure. In accordance with the Law of One Price, if the cash flows, the risks, and the timing under the two strategies are equal, the value of the two strategies for the selling bank must also be the same.

In practice, our theoretical model contemplates two hypothetical scenarios. Under Scenario 1, a bank sells a commercial loan issued to Client A without recourse; if the borrower defaults on this loan, the bank bears zero credit risk. Under Scenario 2, the bank issues a standby letter of credit for Client A, and the bank wholly assumes Client A's credit risk. The latter is the equivalent of a bank internally repackaging Client A's loan as a commercial loan with recourse.

Typically, commercial banks do not engage in the hypothetical scenarios described above; however, they can minimise regulatory taxes by:

1) Creating a portfolio of multiple commercial loans without recourse, which are sold to selected groups of clients.
2) Issuing SLCs for clients of equal credit risk to those whose commercial loans without recourse are included in the aforementioned portfolio.
3) Creating a third portfolio in which commercial loan sales without recourse and the SLCs are treated as loans with recourse, resulting in substantial savings in regulatory taxes.

We assume no government intervention in the form of "regulatory taxes." Then, loan sales with recourse can be shown to be an equivalent strategy to loan sales without recourse, along with a standby letter of credit issue. This relationship can be expressed as follows:

$$LS_{w^*,i} = LS_{w/o,i} + SLC_i \quad (1)$$

where:

$LS_{w^*,i}$ = value to the bank of the i^{th} loan sold with recourse.
Value to the selling bank is the dollar profit earned as an upfront fee or as an interest differential.

$LS_{w/o,i}$ = value to the bank of the i^{th} loan sold without recourse, and

SLC_i = value to the bank of a standby letter of credit guaranteeing the i^{th} loan, which equals the fee earned.

Equation (1) shows that the two strategies are equivalent. We will prove Equation (1) using the payoff functions in a "state preference theory" framework. We start with a number of assumptions. First, we assume complete markets, where all securities can be priced, and there is a unique price for each security. Second, we assume that for every loan, each state falls into one of two (2) groups: (1) a state of bankruptcy or (2) a non-bankruptcy state.

Also, regarding the i^{th} loan, the first group consists of all states in the [0, B_i] interval, where B_i is the last (highest payoff number) state of nature in which bankruptcy occurs. The second group of states consists of the states that fall in the (B_i, ∞) interval, the non-bankruptcy states. We will also use a one-period framework.

In the case of loan sales with recourse, the bank will originate the loan and will immediately sell it with recourse at the beginning of the period (i.e., t=0). The selling bank will pay the discounted face value of the loan to the borrower and will receive an amount equal to the amount that was paid to the borrower plus a premium in the form of an interest differential from the buyer of the loan. This premium represents the bank's compensation for originating and servicing the loan and for bearing the credit risk associated with the loan. At the end of the period (t=i), the borrower will pay off the loan. However, if the borrower is insolvent, the selling bank will take legal possession of the borrower's assets and will pay an amount equal to the face value of the loan to the purchaser of the loan.

Alternatively, if the bank sells the loan without recourse and simultaneously issues a standby letter of credit on the same loan, the bank will engage in the following activities. First, the selling bank will originate the loan by paying the borrower an amount equal to the discounted face value of the loan. Immediately thereafter, the bank sells the loan without recourse to a third party and will receive a payment equal to the discounted face value of the loan, plus compensation for originating and servicing the loan, in the form of an interest rate differential from the third party.

At the same point in time, the selling bank will issue a standby letter of credit guaranteeing the i^{th} loan and will collect fees for that service. At the end of the period (t=i), the borrower will pay off the loan. In case of insolvency, the selling bank will take over the assets of the borrower and will also pay an amount equal to the face value of the loan to the beneficiary of the standby letter of credit.

Let:

D_i = face value of the i^{th} loan,

$A_i(s)$ = end of period value of the i^{th} borrower's assets, under the s^{th} state of nature,[6]

$P(s)$ = price of a pure (primitive) associated with the s^{th} state of nature,

$LS_w{}^*{}_{,i}(s)$ = end of period payoff of the loan sale with recourse of the i^{th} loan under the s^{th} state of nature,

$LS_{w/o,i}(s)$ = end of period payoff of the loan sale without recourse of the i^{th} loan under the s^{th} state of nature,

[6] *Our model assumes that the number of end-of-the-world states of nature is infinite and will arrange those states in ascending order from zero to infinity, according to their payoffs.*

$SLC_i(s)$ = end of period payoff of a standby letter of credit issued to guarantee the i^{th} loan sold without recourse, under the s^{th} state of nature, and

τ_{1i} = "regulatory taxes" incurred by the bank

The following section compares the payoffs of the two strategies at t=i. If the payoffs at t=i are equal, then the t=0 values of the two strategies should also be equal. The t=i value of the payoffs of a loan sale with recourse is the following:

$$\int_0^{\infty} LS_{w^*,i(s)} P(s) ds \tag{2}$$

If the bankruptcy and non-bankruptcy states are separated, the above payoff function can be decomposed as follows:

$$\int_0^{B_i} LS_{w^*,i(s)} P(s) ds + \int_{B_i}^{\infty} LS_{w^*,i(s)} P(s) ds \tag{2a}$$

At this point, we will explore the possible values that $LS_{w^*,i}(s)$ can obtain at the end of the period for different states s. Assuming that the borrower is solvent (i.e. s falls in the interval (B_i,∞)), the cash flows will equal zero, since the selling bank will not be required to make any payments, and the second component of expression (2a) will be eliminated.

If s falls in the interval [0, B_i] (i.e., the borrower is not solvent), the selling bank will incur a loss since it will have to buy back the loan and, at the same time, take over the assets of the borrower whose value will be lower than the face value of the loan. In this case, the cash flow from the loan sale will be negative and equal to $A_i(s) - D_i$.

As a result, the first part of (2a) may be expressed as:

$$\int_0^{B_i} [A_i(s) - D_i] P(s) ds \tag{2b}$$

As expression (2b) illustrates, the t=0 cash flows will be equal to negative Di e^{-r} in the case of a loan sale without recourse. This means that, at t=0, the selling bank will originate the loan and will pay the discounted face value to the borrower. At the same time, the bank will sell the loan without recourse and will collect an amount equal to $D_i\ e^{-r^{**}}$ from the buyer. The value to the bank selling the loan without recourse is equal to $D_i\ (e^{-r^{**}} - e^{-r})$.

Expression (3) shows the value of the payoffs of a loan sale without recourse at t=i:

$$\int_0^{\infty} LS_{w/o,i(s)} P(s) ds \tag{3}$$

Considering the bankruptcy and non-bankruptcy states, (3) can be written as follows:

$$\int_0^{B_i} LS_{w/o,i}\, P(s) ds + \int_{B_i}^{\infty} LS_{w/o,i}\, P(s) ds \tag{3a}$$

A closer examination of the possible values that $LS_{w/o,i}(s)$ may take at the end of the period for different values of s, reveals that cash flows associated with $LS_{w/o,i}(s)$ are not state contingent:

- If s falls in (B_i, ∞), the borrower is solvent and the selling bank will not be required to make any payments. Therefore, the cash flow associated with the loan will equal zero.
- Conversely, if s belongs to (0, B_i) (i.e., the borrower is insolvent), the bank will not have to make any payments since the loan was sold without recourse. Therefore, the cash flow associated with the loan sale will be equal to zero.

Therefore, regardless of the state of the variable s, the cash flow associated with the loan sale will be zero, and LSw/o,i(s) will be state-independent. Thus, the value of the payoff functions in Equation (3) and Equation (3a) will always equal zero. Finally, the payoffs of the standby letter of credit (SLCs) at t=0 will equal the fees collected by the selling bank for issuing such a letter.

The value of the payoffs of the standby letter of credit at t=1 can be expressed as:

$$\int_0^{\infty} SLC_i(s) P(s) ds \tag{4}$$

Taking bankruptcy and non-bankruptcy states into account, (4) can be broken down as follows:

$$\int_0^{B_i} SLC_i(s) P(s) ds + \int_{B_i}^{\infty} SLC_i(s) P(s) ds \tag{4a}$$

We now examine the possible values of $SLC_i(s)$ at the end of the second period for different values of s:

- If "s" falls in (B_i, ∞) interval (i.e., borrower is solvent), the cash flows will equal zero, and the selling bank will not make any payments.
- Alternatively, if s belongs to (0, B_i] (i.e., borrower is insolvent), the bank will have to indemnify the lender and incur the loss.

Since the borrower is unable to make the full payment, the selling bank will take ownership of the borrower's assets, which are valued below the face value of the loan. As a result, the cash flow will be negative and equal to $A_i(s) - D_i$. In this case, expression (4a) can be rewritten as:

$$\int_0^{B_i} [A_i(s) - D_i]P(s)ds \tag{4b}$$

Since the value of expression (4a) always equals zero, the value of the t=1 cash flows of the combination strategy will equal the value of expression (4b). As shown before, expressions (2b) and (4b) are identical; therefore, the value of the t=1 payoffs of a loan sale with recourse will be equal to the value of the payoffs of the combination strategy.

Considering the above, and taking the *Law of One Price* into account, we can conclude that to rule out the possibility of profitable arbitrage, the value of the payoffs at t=0 must be equal under both strategies. That is,

$$\begin{aligned} LS_{w^*,i} &= -D_i e^{-r} + D_i e^{-r} = -D_i e^{-r} + D_i e^{-r^{**}} + SLCfee \\ &= LS_{w/o,i} + SLC_i \end{aligned} \tag{5}$$

or

$$LS_{w^*,i} = LS_{w/o,i} + SLC_i \tag{5a}$$

Equation 5(a) above is Equation (1) restated, *QED*.

The selling bank's ability to honour its SLCs or its loan sales with recourse has not been considered because this risk is identical under both scenarios. Therefore, this ability (or lack thereof) will not affect the bank's decision to sell a loan with recourse versus using the

combination strategy. Therefore, we exclusively focus on the returns generated.

Since both strategies carry the same amount of risk, Equation (1) can be extended to a portfolio of (n) loans, which are sold or issued with SLCs. After adding both sides, we obtain:

$$\sum_{i=1}^{n} LS_{w^*,i} = \sum_{i=1}^{n} LS_{w/o,i} + \sum_{i=1}^{n} SLC_i \quad (6)$$

Equation (6) indicates that bank managers do not need to separately implement the suggested strategy for each loan sold. Instead, they could focus on creating portfolios of loans sold without recourse and portfolios of SLCs issued on other loans, so that the expected cash flows generated will be the same as those generated by equivalent portfolios of loans sold with recourse.

In the absence of "regulatory taxes", there is no benefit of one strategy over the other.[7] Of course, this conclusion will change if "regulatory taxes" are introduced.

We now consider the scenario of government intervention through "regulatory taxes." In view of "regulatory taxes", equation (1) no longer holds because of the additional "regulatory" cash flow associated with a loan sale with recourse. For the selling bank, the value of the loan sale with recourse will be lower unless it can increase the loan's interest differential by an amount equal to the additional "regulatory taxes" it incurs. This can only take place if the demand curve for loan sales with recourse is perfectly inelastic. Otherwise, a portion or all of the "regulatory taxes" will be incurred by the selling bank, reducing its value for the loan sale with recourse.

[7] *Our model considers three types of regulatory taxes: (1) reserve requirements, capital requirements, and FDIC deposit insurance premiums. Regulation D stipulates that when a loan is sold with recourse, the sales proceeds remain on the bank's books and are treated as deposits (GAO, 2016). As a result, the bank is required to maintain additional reserves at the Fed, which increases the costs of loan sales with recourse (GAO, 2016). Conversely, under Regulation D, the sale of an asset under the seller's endorsement or any other type of guarantee does not constitute a primary obligation of the seller. It would not give rise to the creation of a reservable deposit if the seller has not entered into an unconditional promise to repurchase (the asset) in the event of default (of the underlying asset). Finally, regarding the FDIC deposit insurance premium, when a loan remains on the selling bank's books, the sale proceeds are treated as deposits and included in the premium calculation.*

Equation (1) would be restored if the portion of the "regulatory taxes" is added to the value of the loan sold with recourse at t=0, or

$$LS_{w,i} + \tau_{1i} = LS_{w/o,i} + SLC_i \quad (7)$$

In expression (7), $LS_{w,i}$ represents the value to the bank of the i^{th} loan sold with recourse, in the presence of "regulatory taxes". A profit-maximising selling bank should prefer the strategy shown on the right-hand side of expression (7), instead of the one shown on the left-hand side, in order to save a dollar amount equal to τ_{1i}.

The relationship shown in (6) can be extended to encompass all n loans for which the above procedure is followed. By summing both sides of expression (7) over the n loans, we obtain:

$$\sum_{i=1}^{n} LS_{w^*,i} = \sum_{i=1}^{n} LS_{w/o,i} + \sum_{i=1}^{n} SLC_i - \sum_{i=1}^{n} \tau_{1i} \quad (7a)$$

In the absence of "regulatory taxes", the τ_{1i} terms equal zero for all i and r^* will equal r^*_1. Therefore, the value of a loan sold with recourse would equal the value of the same loan sold without recourse plus the value of a standby letter of credit issued to guarantee this same loan. By contrast, if "regulatory taxes" are introduced, the value of the strategy shown on the left hand side of expression (7) would be lower than the value to the bank of the strategy shown on right hand side and the difference would equal the term τ_{1i} (i.e., the value of the "regulatory taxes" imposed on the i^{th} loan sold with recourse). Therefore, if "regulatory taxes" are introduced, a bank that intends to sell a loan with recourse would be better off selling the loan without recourse and issuing a standby letter of credit guaranteeing the loan.

To generalise the results described above, we will consider a scenario in which the bank issues a standby letter of credit to guarantee the k^{th} loan, while simultaneously selling the m^{th} loan without recourse. We assume that loans k and m are of similar size and of the same risk class, with or without monitoring. Therefore, the bankruptcy state is the same for both or B_i.

Based on the above, we develop the following variations of Equations (1) and (7):

$$LS_{w,k} = LS_{w/o,k} + SLC_m \quad (8)$$

Equation (8) assumes the absence of "regulatory taxes".

$$LS_{w,k} + \tau_{1k} = LS_{w/o,k} + SLC_m \quad (9)$$

Equation (9) assumes that "regulatory taxes" are introduced.

To generalise (9), assume that all pairs of *k* and m loans are of equal size and fall into the same risk category. Thus, we obtain:

$$\sum_{k=1}^{n} LS_{w,k} + \sum_{k=1}^{n} \tau_{1k} = \sum_{k=1}^{n} LS_{w/o,k} + \sum_{m=1}^{n} SLC_m \quad (9a)$$

To demonstrate that Equation (8) holds, we explore the payoff functions suggested by both sides of this equation. Once this has been established, the validity of equation (9) follows. Let $SLC_m(s)$ be the s^{th} state-of-nature end-of-period payoff of a standby letter of credit issued to guarantee the m^{th} loan. Since loan *k*, which is sold, and loan *m*, which is guaranteed by a standby letter of credit, are of equal size, we can assume that for s falling into the [0, B_i] interval, the payoff of loan *k* that is sold, $Ak(s) – D_k(s)$, and the payoff of the standby letter of credit on loan *m*, $A_m(s) – D_m(s)$, are equal, as Equation (10) shows:

$$A_k(s) - D_k(s) = A_m(s) - D_m(s) \quad (10)$$

To prove that Equation (8) holds, we will use the no-arbitrage method discussed earlier. The value of the t=1 payoffs of the standby letter of credit on loan *m* equals the following:

$$\int_0^{\infty} SLC_m P(s) ds$$

The payoff function shown above can be decomposed into the bankruptcy and non-bankruptcy states as follows:

$$\int_0^{B_i} SLC_m P(s) ds + \int_{B_i}^{\infty} SLC_m P(s) ds$$

The second term always equals zero, and the decomposed payoff function reduces to:

$$\int_0^{B_i} [A_{im}(s) - D_m(s)] P(s) ds$$

As indicated earlier, it can be shown that the t=1 payoff of the loan sale with recourse of loan *k* will equal the following:

$$\int_0^{B_i} [A_k(s) - D_k(s)] P(s) ds$$

By virtue of Equation (10), the following equality holds:

$$\int_0^{B_i} [A_k(s) - D_k(s)]P(s)ds = \int_0^{B_i} [A_m(s) - D_m(s)]P(s)ds \qquad (11)$$

Since the payoffs of the loan sale without recourse will, as mentioned earlier, be equal to zero, the above equality establishes Equation (8) and by extension Equations (9) and (9a). However, the argument could be made that Equation (9a) holds in a portfolio sense. Another plausible argument is that the volume of the n_1 loans is approximately equal to the volume of the n_2 loans. As a result, Equation (9a) could be seen as describing an actual daily situation faced by banks.

Normally, banks will not enter the type of transactions suggested by the right-hand side of Equation (6) for the same loan. However, Equation (7) can be viewed in a portfolio sense, that is, as Equation (7a). What is more, going over the bank's books and "off-books", one would not expect to obtain pairs of loans *k, m* that are of equal size and risk, as Equation (9a) requires.

Conversely, if a large number, n_1, of loans are sold without recourse and a large number, n_2, of SLCs are issued on different loans, and, if the n_1 and n_2 loans are similar in size and of the same average risk, the selling banks would be effectively selling loans with recourse and Equation (9a) would hold. This suggests that banks that wish to sell loans with recourse, having recognised the benefits of selling such loans "indirectly," will consider loan sales without recourse and issuance of SLCs as joint activities.[8]

4. Conclusions

This paper presents a theoretical model that examines complementarities between two OBS activities commonly used by banks: (1) commercial loans without recourse, and (2) SLCs. Our theoretical model demonstrates that banks have an incentive to create portfolios of loans sold without recourse and match them with portfolios

[8] *For example, a selling bank may assume the "with recourse" position by selling the loan of a blue-chip corporation, without recourse, while simultaneously issuing a standby letter of credit to guarantee a commercial paper issue (of similar size) by the same corporation or by a similar blue-chip corporation. This example illustrates how the previous relationship can be implemented. In practice, a relatively small share (less than 10%) of commercial paper is usually backed by SLCs, and loan commitments remain as the most used backup facility.*

of SLCs on other loans with similar risk profiles to avoid the "regulatory taxes" associated with reserve requirements at the Fed, capital requirements, and the payment of FDIC deposit insurance premiums. As a result, banks have financial incentives to create "synthetic" portfolios of loans with recourse.

This strategy allows banks to avoid the "regulatory tax~~es~~" costs associated with loan sales with recourse, while maintaining their traditional credit analysis and credit risk-taking functions. It also allows banks to recapture their funding, while continuing to exploit their comparative advantage in the collection and use of private information regarding the creditworthiness of their clients. Banks that follow this strategy are able to utilise their resources more efficiently.

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