Effects of streaming loans for commodity producers

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Abstract

This paper analyzes a source of financing for commodity producers known as a streaming loan, where the producer makes periodic payments in proportion to their level of production. Streaming loans functions like a cropshare contract, whereas fixed rate debt is like a wage contract. Thus, producers can reduce the variance of profits by financing with streaming loans rather than debt. I establish this result when commodity prices are constant or random, but independent from the quantity of production.

Keywords: Streaming loan; cropshare; contract; capital structure; profitability.

JEL: D20, G20, G32, Q14

Effects of Streaming Loans for Commodity Producers

1. Introduction

Streaming loans are an innovative type of financing for commodity producers where the cost of capital is proportional to production. Streaming loans are mainly used in mining as a type of financing that combines features of debt and equity (Aspermont Media, 2013). Streaming loans for precious metal mines generally range from $35M to $1.9B and provide a last dollar towards mine construction in exchange for the right to buy a fraction of production at a reduced price over the life of the mine (Amm & Arellano, 2014, p.16). However, streaming loans can be adapted to producers of other commodities. Input Capital is the first public company to provide streaming loans to farmers, specifically canola producers in Western Canada. The agricultural streaming loans are smaller than mining streams, roughly $2M to each farmer in exchange for a fraction of production over five to ten years (Input Capital, 2014, p. 26), but the agricultural streams function in a similar manner as the mining streaming loans.

Streaming loans are designed to function as a cropshare, but with perfect information. The fundamental similarity between cropshare and streaming loans is that a producer receives capital in exchange for a fraction of output. Cropshares are subject to imperfect information because they are informal contracts between farmers (Allen & Lueck, 2002) or, sometimes, gold miners (Hallagan, 1978). In contrast, streaming loans are formal contracts designed to resolve imperfect information. For example, Input Capital (2013) requires all farmers who receive streaming loans to work with an agrologist who monitors effort and output. Allen (2012) argues that the ability to resolve imperfect information is a defining feature of our modern age; thus, a streaming loan can be seen as an evolution of the traditional cropshare into a modern tool in corporate finance.

I present a new model of streaming loans in the context of the financial statements of a commodity producer. I assume the producer has a simplified balance sheet with constant amounts of assets and equity, but can replace debt with a streaming loan. I study how the probability distribution of profit changes as the producer uses more streaming loans in place of debt. I show that streaming loans reduce the variability of the producer's profit because the proportional repayments provide a natural risk management function. I also identify bounds on the maximum size of the streaming loan and fair pricing conditions for the streaming loan.

2. Literature Review

Although there has been little discussion of streaming loans in the research literature, we can learn much from much the large literature on cropshares. Classical economic theory suggests that a cropshare is not an optimal contract because it causes a tax-like distortion where the producer does not receive their marginal product of labour. However, cropshares appear widely across human history (Reid, 1975). This disconnect between classical theory and reality led to a productive academic discourse, exemplified by Stiglitz's (1974) theory of risk sharing. Stiglitz helps resolve the puzzle of the cropshare in classical theory by showing that a farmer who rents land for a fixed cost keeps all the risk of uncertain profits, but a farmer who rents land with a cropshare shares some risk with the landowner. Stiglitz's approach is known as risk sharing because it emphasizes a fundamental feature of cropshares: a cropshare reduces variability of profits for the farmer. This risk sharing feature of cropshares is present in streaming loans.

An important part of Stiglitz (1974) theory of risk sharing is imperfect information, where “the input of the worker could not be observed, but only his output, and his output was not perfectly correlated with his input” (Stiglitz, 2001, p. 481). This idea has provided a workhorse model for research on cropshares and is used in diverse settings such as the film industry (Gil & LaFontaine, 2012) or franchise agreements amongst entrepreneurs (Pruett & Winter, 2011). However, streaming loans are only used in specific settings that require an intermediary to fully monitor the inputs and outputs. Thus, the general assumption of imperfect information is inappropriate for streaming loans.

The design of streaming loans also challenges the assumptions of influential models for cropshares. Allen and Lueck (1993, 2002, 2009) provide a comprehensive analysis of cropshares and they use imperfect information to allow for different types of moral hazard. For example, “The intuition of the model suggests when soil exploitation is a serious problem cropshare contracts are used. When underreporting output is a serious problem, cash rent contracts are used” (Allen & Lueck, 2009, p. 883). These two types of moral hazard (soil exploitation or underreporting) are relevant to informal cropshare contracts between farmers, but not streaming loans. Soil exploitation does not apply because a streaming loan exchanges financial capital with a farmer, not farmland. Underreporting does not apply because a streaming loan requires a high degree of supervision of farmer activity. Thus, there is a need to develop new models to analyze streaming loans.

3. Theoretical Analysis

3.1 Financial Statements for Producer

Assume the producer has a fixed asset A and three types of capital: debt D, streaming loan S, and equity E. Throughout the analysis, I assume that the asset and equity do not change but the debt and streaming loans change by an equal and opposite amount. I also assume the debt and stream are perpetuities. Equation (1) defines the balance sheet for the producer:

$$(1) \quad A = D + S + E.$$

Assume that the asset yields some quantity of production Q each period, which follows a known stationary distribution with mean E(Q) and variance V(Q). The producer sells the quantity at market price P, which can be constant or random. When they are random, I assume prices are independent of quantity with mean E(P) and variance V(P). Thus, the model with constant prices represents a producer that has fully hedged price risk and the model with random prices represents a market with perfect competition.

I do not consider production costs because I assume these are exogenous to the capital structure decision. However, I do consider interest payments on the debt. I suppose the producer pays rate r on the debt each production period. Thus, if the producer did not use a streaming loan then the profit would be revenue PQ minus financing costs rD.

Based on the contracts offered by Input Capital (2013), a producer who uses a streaming loan of size S must provide the lender with some fraction of output T_s at an artificially low price, P_s ($0<P_s<P$ almost surely). The producer sells the rest of their output $1—T_s$ at the market price. This formulation provides a natural upper bound on the size of the stream because the producer cannot provide more than 100% of their production, $0 \leq T_s \leq 1$. The income statement for a producer with a streaming loan is given by Equation (2).

$$(2) \quad N = PQ(1 - T_s) + P_s Q T_s - rD.$$

The provider of the streaming loan must be able to extract returns that are proportional to the size of the loan: as the size of a streaming loan increases, the lender requires a larger fraction of the producer's output. The fraction T_s provides the key variable that determines returns for the lender. I assume that the fraction is linearly related to stream size, as in Equation (3).

(3) $T_s = kS$, for some $k > 0$.

3.2 Fair Pricing of Streaming Loan

I refer to the fair price of a streaming loan as the value for the coefficient k that ensures the size of the streaming loan does not change average profits. In other words, the expected cost of the streaming loan is equal to the cost of debt financing. Substituting the balance sheet in into the profit equation gives Equation (4), which admits the fair price k* such that dE(N)/dS=0.

(4) $N = PQ + (P_s - P)QkS - r(A - S - E)$.

An exact expression for the fair price k* is given in Equation (5), with price P constant.

(5) $k^* = r/(E(Q)(P - P_s))$.

Substituting the fair price into the profit equation leads to Equation (6).

(6) $N = PQ - (Q/E(Q))rS - rD$.

Equation (6) describes the profit for a producer who uses a fair priced streaming loan under constant commodity prices. The equation shows that the cost of capital for the streaming loan is (Q/E(Q))r, which is random but linearly related to output Q. Thus, a fair-priced streaming loan functions like debt with a variable interest rate that is indexed to production.

3.3 Effect of Streaming Loan

Since the size of the streaming loan S is exogenous to variation in quantity or price, changing the size of the streaming loan changes the entire distribution of profits. I show that a streaming loan reduces variance of profits when prices are constant or random.

Result 1: A streaming loan reduces the variance of profits when prices are constant.

Proof: I establish proof by construction. I derive the exact expression for the variance of profits and show it is decreasing in the size of the streaming loan.

Variance of profits V(N) is given by Equation (7),

(7) $$V(N)=V(Q)(P + (P_s-P)kS)^2.$$

I denote $b(S)=P+(P_S-P)kS$ and establish two properties below (i) $b(S)>0$ and (ii) $db(S)/dS<0$.

(i) $0< P_S <P$ implies $1<P/(P-P_S)$. Since $kS\leq 1$, it follows that $kS\leq P/(P-P_S)$ and $0\leq P+(P_S-P)kS$. Thus, $b(S)\geq 0$ for all S.

(ii) The derivative is $db(S)/dS=(P_S-P)k$, which is always negative because $P_S-P<0$ and $k>0$. Thus, $db(S)/dS<0$ for all S.

The derivative of variance is $dV(N)/dS=2V(Q)b(S)db(S)/dS$. Since $V(Q)>0$, $b(S)>0$, and $db(S)/dS<0$, it follows that the variance of profit decreases as the size of the streaming loan increases, $dV(N)/dS<0$. Q.E.D.

Result 2: A streaming loan reduces the variance of profits when prices are random and independent of quantity.

Proof: Provided in the Appendix.

Results 1 and 2 show that Stiglitz's (1974) risk sharing results extend to the present context of capital structure.

4. Further research

This paper introduces streaming loans, which are an alternative to debt and equity financing used by producers in mining and agriculture. I argue that streaming loans function like a cropshare with perfect information and show that they provide a risk sharing function for the producer. My research is guided by streaming loans as they currently exist and I do not explore the general conditions under which streaming loans are the optimal contract type. In fact, there are other features of streaming loans that deserve attention. For example, Input Capital (2013) states that farmers use streaming loans to buy new equipment or reduce operational costs but my model only allows them to reduce debt. Thus, it is important to extend my analysis to consider how a producer can use proceeds from a streaming loan to change their assets or cost structures.

This paper gives limited consideration to a streaming loan from the lenders' perspective, which leaves important questions unanswered. For one, what is the risk-adjusted rate of return for a portfolio of streaming loans? This question is relevant to the valuation of providers, such as Input Capital. A related question is how to determine the principal value for a streaming loan? The answer to this question would require greater focus on the duration of the loan and conditions of repayment.

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Appendix –Proof of Result

Result 2: A streaming loan reduces the variance of profits when prices are random and independent of quantity.

Proof: I show that profit is a product of two independent random variables, identify expression for variance of product, and then show each term decreasing in streaming loan. The profit N is given by Equation (A1),

(A1) $N = Q(P(1-kS) + P_S kS) - rD.$

I refer to two random variables, X and Y, where X=Q and $Y=P(1-kS)+P_S kS$. Since the interest rate r and debt level D are constant, the variance of profit V(N)=V(XY). The general expression for the variance of a product of two independent random variables is given by Equation (A2), as in Goodman (1960).

(A2) $V(XY) = E(X)^2 V(Y) \;+\; E(Y)^2 V(X) \;+\; V(X)V(Y).$

Since E(X)=E(Q) and V(X)=V(Q), both terms are constant with respect to change in S. However, $E(Y)=E(P)+kS(P_S-E(P))$ and $V(Y)=(1-kS)^2V(P)$ vary with S. The derivative of the variance of profit with respect to change in S is given by Equation (A3).

(A3) $dV(XY)/dS = E(X)^2 dV(Y)/dS + 2E(Y)V(X)dE(Y)/dS + V(X)dV(Y)/dS.$

I establish that both E(Y) and V(Y) are decreasing in S below.

(i) $dE(Y)/dS=k(P_S-P)<0$ because $P>P_S>0$.

(ii) $dV(Y)/dS=2(1-kS)(-k)V(P)<0$ because $(1-k)>0$, $V(P)>0$, and $-k<0$.

This establishes that each term in dV(XY)/dS is negative. Q.E.D.