Successful Efforts and Full Cost Accounting as Measures of the Internal Rate of Return for Petroleum Companies

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Successful efforts and full cost reporting have been the primary methods of financial reporting for oil and gas producing companies for many years. Their very different approaches have made financial reporting in these indS Co)Pe Ï +

was so controversial that that the SEC reversed its policy of adopting FASB standards and has proposed its own rules. These rules allo the continuation of both full cost and successful efforts reporting and experimentation with a third method, called Reserve Recognition Accounting.

The principle of RRA is the determination of the present value of reserves and yearly changes in the value of these reserves. RRA is not the focus of this paper.

Among the issues raised, in choosing the financial reporting standard, has been the effect the standard would have on capital costs, access to capital markets, and competition in the oil and gas industries. The focus of this paper is to determine which of these accounting methods provides a book rate of return closer to the actual economic rate of return (i.e., the internal rate of return) of a firm. Book rate of return has become a standard measure of company and industry performance, partik ol

r = internal rate of return[1]
N = economic life of asset

let k(r) represent the Laplace transformation of K(t), $\sum_{1}^{N} \frac{K(t)}{(1+r)^t}$,

then

$$hk(r) = h \sum_{1}^{N} \frac{K(t)}{(1+r)^t}.$$

The r in equation (1) represents the internal rate of return earned by investment in new drilling operations of the firm in any year.

$$Y = \backslash + B = hk(r) \qquad (1)$$

Accounting Rate of Return of the Firm

The accounting rate of return of an all equity firm is defined as follows:[2]

$$\text{Accounting Rate of Return} = \frac{\text{Net income}}{\text{Net Assets}}$$

Full Cost Accounting

Under the full cost accounting approach, income is defined as cash flow less amortization of exploration expenses. Net assets are composed of the capitalized exploration expenses less the portion that has been amortized.

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1 An investment has a unique internal rate of return if the initial cash flows are followed by net cash inflows.

2 The introduction of debt does not materially change the results.

Total cash flow of the firm at any time is composed of the individual cash flos received from each existing investment. For a firm with a constant groth rate of investment, g, the investment made two periods ago is smaller than the investment made one period ago by the factor (l+g). The cash flows have the same relationship. The cash flow of the firm at time can be expressed as

$$\text{Cash flow (T)} = hk(l) + \frac{hK(2)}{l+g} + \frac{hK(3)}{(l+g)^2} + \cdots + \frac{hK(N)}{(l+g)^{N-1}}(l+g)^T$$

$$= (l+g)^T \sum_{l}^{N} \frac{K(t)}{(l+g)^{t-1}}$$

$$= (l+g)^{T+l} \sum_{l}^{N} \frac{K(t)}{(l+g)^t}$$

$$= (l+g)^{T+l}\, hk(g)$$

where:

N = economic life of asset

g = growth of investment

k(g) = The Laplace transformation of K(t), $\frac{K(t)}{(l+g)^t}$

T = The age of the firm ≤ N

Since all of the firms' investments have the same cash-flow profile, K(l) is the cash flo per dollar invested, received in the first year from any investment. Similarly, K(2) is the cash flow per dollar invested, received in the second year from any investment.

The total amortization expense of the firm at any time T is equal to the sum of the amortization expense of each existing project. Letting D(t) represent the amortization expense of a project of age t, the total amorization expense may be written as:

$$\text{Total Amortization Expense } (T) = D(1) + \frac{D(2)}{1+g} + \frac{D(3)}{(1+g)^2} + \cdots + \frac{D(N)}{(1+g)^{N-1}}$$

$$= (1+g)^{T+1} \sum_{1}^{N} \frac{D(t)}{(1+g)^t}$$

$$= (1+g)^{T+1}\, d(g)$$

where:

$D(t)$ = amortization expense of project at age t

N = economic life of asset

g = growth rate of investment

$$d(g) = \frac{D(t)}{(1+g)^t}$$

Net income at any time T is therefore equal to cash flow minus depreciation:

$$\text{Net income}_{(T)} = [(1+g)\, k(g) - (1+g)\, d(g)](1+g)^T$$

Total assets at time T equals total gross assets (the sum of gross investment of each investment) less total accumulated depreciation (the sum of the accumulated amortization of each investment).

$$\text{Total assets}_{(T)} = \frac{(1+g)^{T+1}}{g}\, y[1-(1+g)\, d(g)]$$

The accounting rate of return, RFC, under the full cost method--income divided by net assets--is equal to:

(1+

Successful Efforts Accounting

Under successful efforts accounting, dry-hole expenses are deducted from cash flow in computing income. The only expenses amortized are those of successful exploration. Under successful efforts accounting net income equals cash flow, (l+g) hk(g), less dry-hole expense, s, less amortization of existing capitalized assets, (l+g) ad(g):

$$\text{Net income}_{(T)} = [(1+g)\, hk(g) - S-(1+g)\, ad(g)](1+g)'$$

As only expenses for successful wells are amortized under successful efforts accounting, net assets under this method equals $\frac{C\ell}{y}$ of full cost accounting net assets.

$$\text{Net assets}_{(,)} = \frac{(1+g)}{g}\, a[1-(1+g)\, d(g)]\, (1+g)'$$

The accounting rate of return with successful efforts accounting, RSE, is

$$RSE = \frac{(1+g)[hk(g) - \beta-(1+g)\, ad(g)]}{\frac{(1+g)}{g}\, a[1-(1+g)\, d(g)]} \frac{(1+g)L}{(1+g)^T}$$

$$= \frac{hk(g) - r - ad(g)}{\ddot{g}[1-(1+g)\, d(g)]} \qquad !,=",$$

Substituting for h, RSE becomes

$$RSE = \frac{\frac{k(g)}{Yk(r)} - \frac{8}{Tl+q)} - ad(q)}{\int_{g}^{1} e,6\,'!,6,+g)\ d(g)\ ]}$$

but $y\ _{7\mathrm{G}\ B\mathrm{G}} + 8$

substituting for y

$$RSE = \frac{k(g)}{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}$$

$$\frac{1}{g} \qquad\qquad (?",$$

t

The magnitude of the second term is determined by the ratio of dry holes to successful explorations. The greater the success rate of a firm, the less effect the choice of accounting technique has on its accounting rate of return.

Income Tax Effects

After Tax Return

The after-tax return for these industries is complicated by the ability to expense for tax purposes certain costs of successful wells, such as intangible drilling costs, not expensed for book purposes. The after-tax model assumes that all expenses of unsuccessful wells are expensed for tax purposes, as well as a portion of costs 1rtY

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$$b« = \frac{¡«\ \overline{j\&u}\ \overline{1+r}\ \$3*E\%«>N?^N\$u¥}{h\$u\%«\$3*N\%«}$$

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$$IB=N« = \frac{QY\ *\ \frac{LN«}{j\&u«} - \frac{>N}{j\&u«}\ *\ \$3*\ \%«>N?^N\$u\%«\frac{h\$\_\%«}{h\$u\%«}*\ ¡\ \$\_\%«\$3*N\%}{lPj*\$j\&\_\%«\ \$\_\%k«}}$$

$$RFC^T = \frac{Q^3\ *\left(\ I\ -\ \frac{\alpha}{\gamma}\ \frac{N«}{\$j«\&u\%«}\ *\ \$j«*\ !\ \%«\ ¨N?^N\$u\%«\frac{i\$\_\%«}{h\$«u\%«}*\ \$`\%«\$3*N\%«}{3}}{}$$

$$RSE^T \quad \overline{\qquad\qquad\qquad\qquad\qquad\qquad}$$

$$RSE^T = \frac{\overline{\qquad} \qquad\qquad\qquad\qquad \overline{\qquad} \quad \overline{\qquad}}{\overline{\qquad\qquad} - - \overline{\qquad\qquad} \qquad - \qquad \overline{\qquad} \; \overline{(1+g)}}$$

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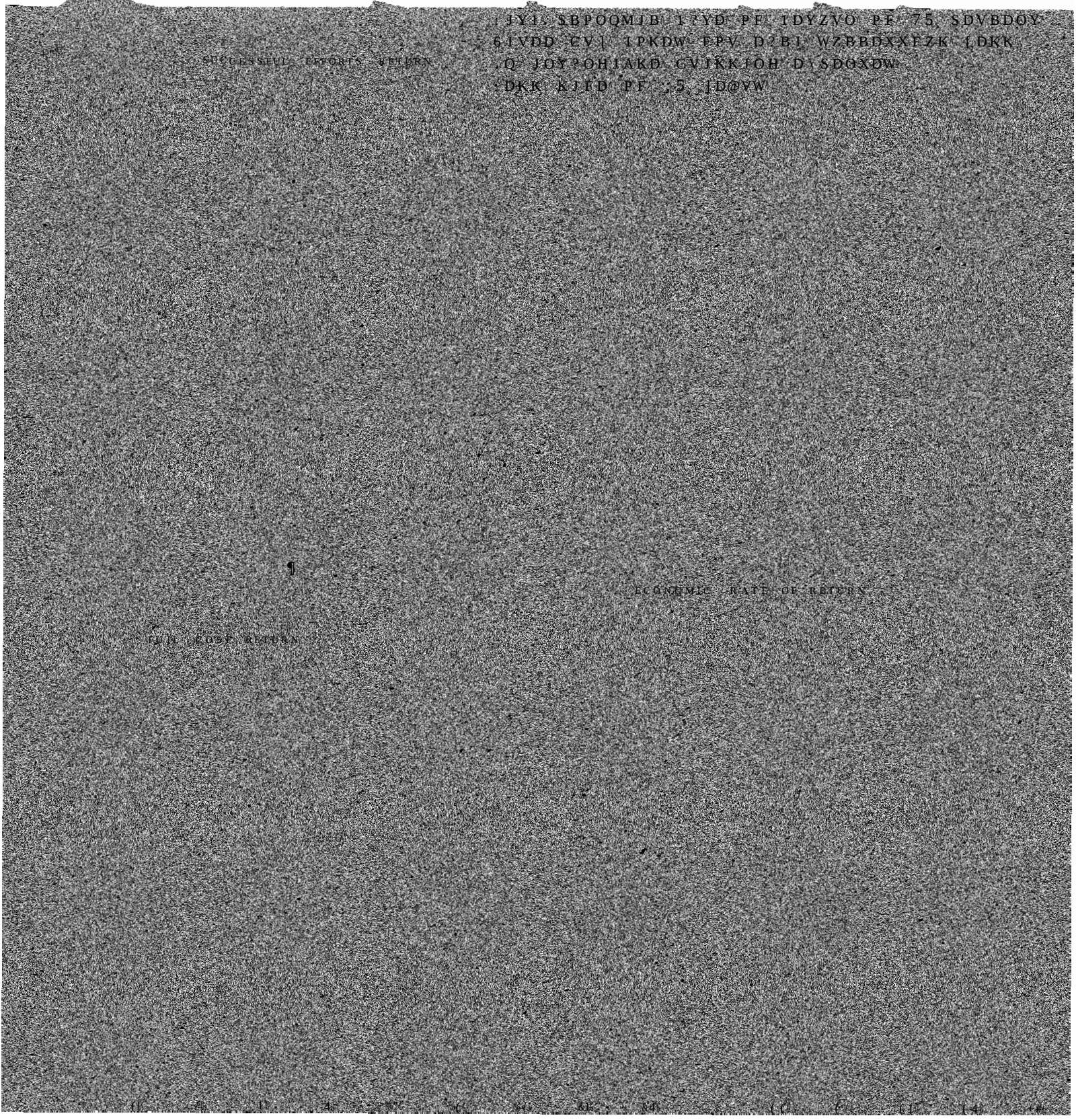

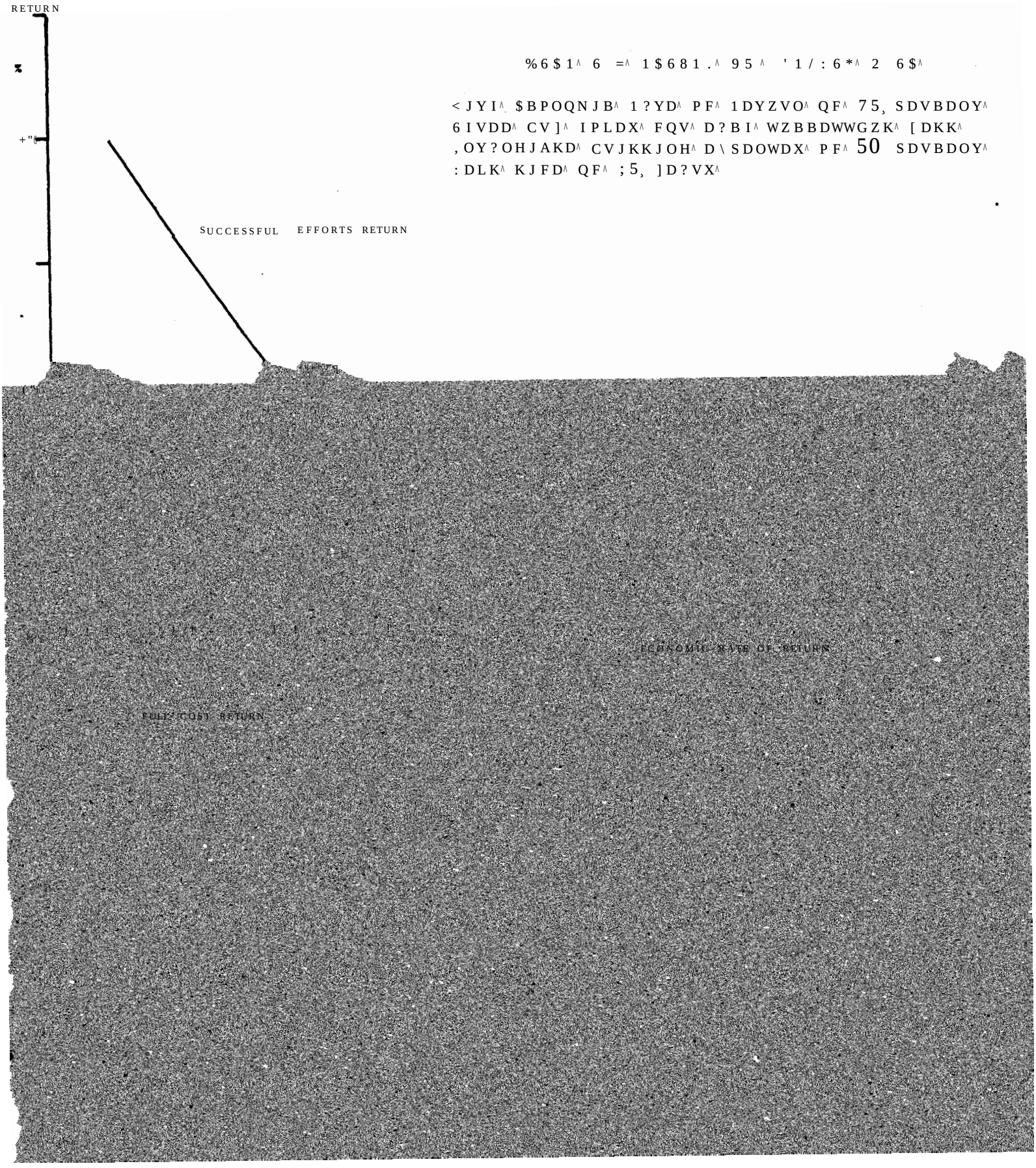

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