

Real-Options Analysis: A Luxury-Condo Building in Old- Montreal



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Project Description

- Luxury condo building
- Inspired from a current project
 - Old-Montréal, Québec, Canada
- Standalone tower building
- Only one construction site



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Goals of Current Analysis

- Apply methods in decision and real-options analysis to a real-estate project
- Find major sources of uncertainty in project
 - Number of contracts signed during sales period
- Find the value of flexibility under realistic constraints
 - Once owners start moving in, stop construction
- Compare outcomes from fixed building design with flexible one

Basic Data – Fixed Design

- Build 24 units based on experts' projections
- Duration of construction: exactly 12 months
- Average revenue per condo (due to differing designs and size): 350 000\$
- Buyers pay initial 10% deposit, difference at month 12
- After month 6, maintenance costs: 5000\$/month
- Construction cost per condo: 100 000\$
- Site cost and decontamination: 1 100 000\$
- Discount rate: 10%

Basic Data – Flexible Design

- Start with 18 units with possibility to expand (cheaper initial investment) but incorporate:
 - Stronger structure to add condo units
 - Possibility to add parking lots, plumbing, electricals, etc
- Option to expand exists **ONLY ONCE** at end of sales period
 - “In-project” European call option
- Sales period same as construction period: 12 months
 - Goal: sell as many units as possible
- Exercise option if number of signed contracts > 18
- Maximum number of condos: 30

Basic Data – Flexible Design (cont)

Costs of flexibility

- Flexible structure: 300 000\$
- Compensation to contractor for uncertain duration of project: 300 000\$
- Compensation to buyer for delay: 3000\$/month/condo
- Expansion in series of 6 condo units
 - 165 000\$ for condos 19 to 24 (10% cost increase)
 - 176 000\$ for condos 25 to 30 (10% cost increase)

Two-Stages Decision Analysis

Property

- To simplify, once signed, contracts are irrevocable
- Simulation of number of contracts signed (D)
 - Uniformly distributed probability function varying between 0 and 3 each month
 - One 12-months sales period is obtained by adding outcome each month. Gives 1 simulation
 - 1000 simulations were done
 - Sampled at intervals of number of contracts: low ($D \leq 18$); medium ($18 < D \leq 24$); high ($D > 24$)

Two-Stages Decision Tree

De: decision node C: Chance node D: number of contracts P: probability

		Mean NPV			Mean NPV	
		High (D > 24)	P = 8,3%	2 627 431,44 \$		
Fixed	C	Medium (18 < D <= 24)	P = 53,4%	1 956 375,31 \$		
		Low (D <= 18)	P = 38,3%	419 367,02 \$		
De						
		High (D > 24)	P = 8,3%	1 500 227,37 \$	De	2 804 060,91 \$
Flexible	C	Medium (18 < D <= 24)	P = 53,4%	1 356 654,60 \$	De	2 058 212,71 \$
		Low (D <= 18)	P = 38,3%	747 455,16 \$	De	747 455,16 \$
				Stage 1	Stage 2	

Two-Stages Decision Analysis

● Results

- Both projects are profitable
- At stage 1, fixed design more profitable than flexible, but;
- Flexibility to expand creates opportunity for increased profits → higher profit than fixed case
- European call option has positive value

Design	Expected NPV
Fixed	1 423 398,79 \$
Flexible Stage 1	1 135 247,75 \$
Flexible Stage 2	1 618 097,97 \$
Value of Option	194 699,17 \$

Lattice Decision Analysis

- Property

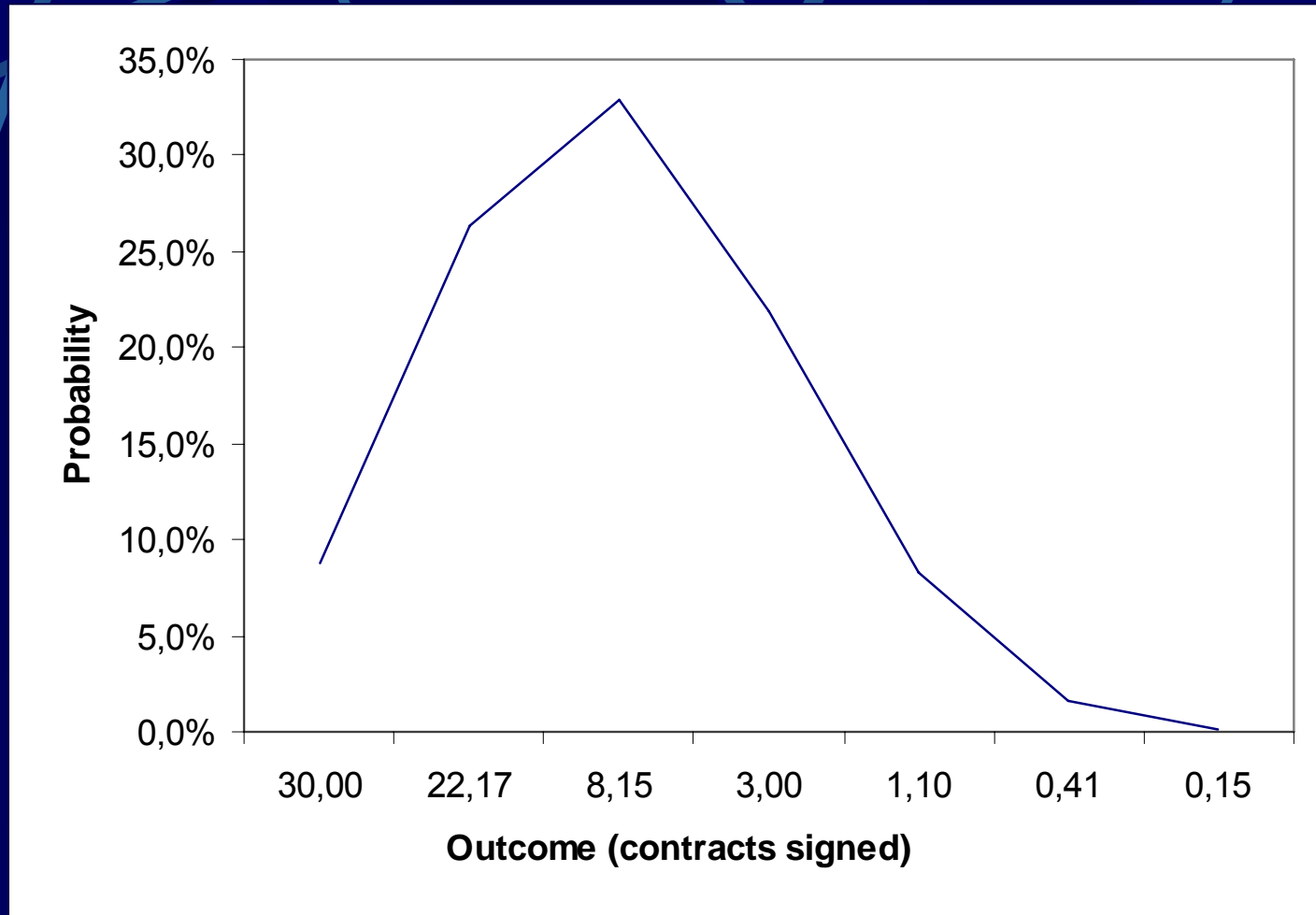
- Contracts are revocable during sales period
- Leads to profitability results different than two-stages decision analysis

- Equations used: 1) $p = 0.5 + 0.5(v/\sigma)\sqrt{\Delta t}$
2) $u = e^{\sigma\sqrt{\Delta t}}$ 3) $d = 1/u$

Calculated Values	
Number of months per period (months)	2
Projected number of contracts growth per period	6
Total projected number of contracts	36
Growth rate per period (v)	16,7%
Volatility of number of contracts signed (σ) per period	70,7%
u	1,649
d	0,607
p	66,7%

Lattice Decision Analysis (cont)

Lognormal Probability Distribution of Contracts Signed at
Period 6 (month 12)



Lattice Decision Analysis (cont)

● Results

- Both projects are unprofitable due to revocable contracts
- Option has positive value: reduced losses
- Depending on constraints, flexibility could offer opportunity for increased profits

Design	NPV
Fixed	-679 799,27 \$
Flexible	-269 115,78 \$
Value of Option	410 683,49 \$

Concluding Remarks

● Design Recommendations

- European “in-project” call option in flexible design offers potential for increased profits

● Model Assumptions and Considerations

- Profitability of projects may change depending on initial constraints and associated costs
- Future work:
 - Allow for revocable contracts in two-stages DA
 - Simulate random number of contracts using same probability distribution as for lattice analysis (with same μ and σ)