

NYC Citi Bikes



Decision Models

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Agenda



Background: Citi Bike Share Program



Assumptions: Demand Estimation



Solver: Optimization Problem



Precision Tree: Base-Case & Worse Case Scenario



Conclusion: Recommendations



Questions



The Citi Bike program started in May 2013 and has yet to produce a profit.

History:

- NYC DOT researched alternative forms of transportation
- Proposed bike share program operated by Alta Bicycle Share
- Sponsored by Citi
- Opened to the public in May 2013
 - 330 stations
 - 6,000 bikes
- Current pricing structure:



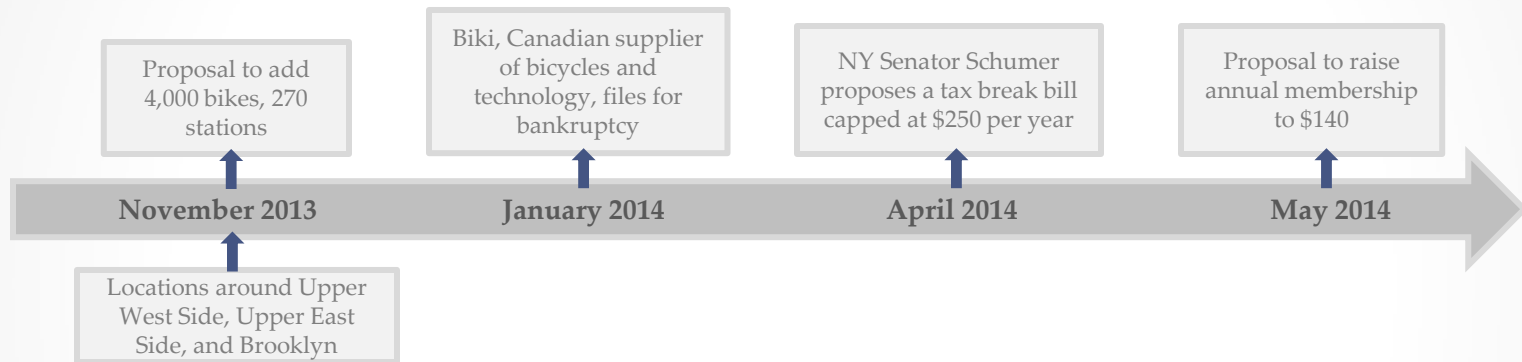
| Option | Time Permitted | Cost |
|-------------------|----------------|------------|
| Annual membership | 45 minutes | \$95/year |
| 7-days | 30 minutes | \$25/week |
| 1-day | 30 minutes | \$9.95/day |

*Overages apply when bikes are not returned within 45 minutes for annual members, and 30 minutes for 7-days & single day users



To address this concern, we can use decision models to find the optimal price to charge annual members based on the tax effects.

Timeline:



Current Issues:

- Financial concerns to break-even
- Annual pass holders are the largest market: ↑ usage but ↓ price

Questions:

- What is the demand for a given price level?
- What is the optimal price for annual membership?
- What is the base-case and worse-case scenario based on the proposed tax break bill?



Assumptions:

Estimating Demand

We estimated demand using a similar pricing structure to Barclays' bike share program in London.

'Boris bikes' scheme imposes 100% price rise

London cyclists hit with inflation-busting increase on 24-hour, weekly and yearly access

Mark King

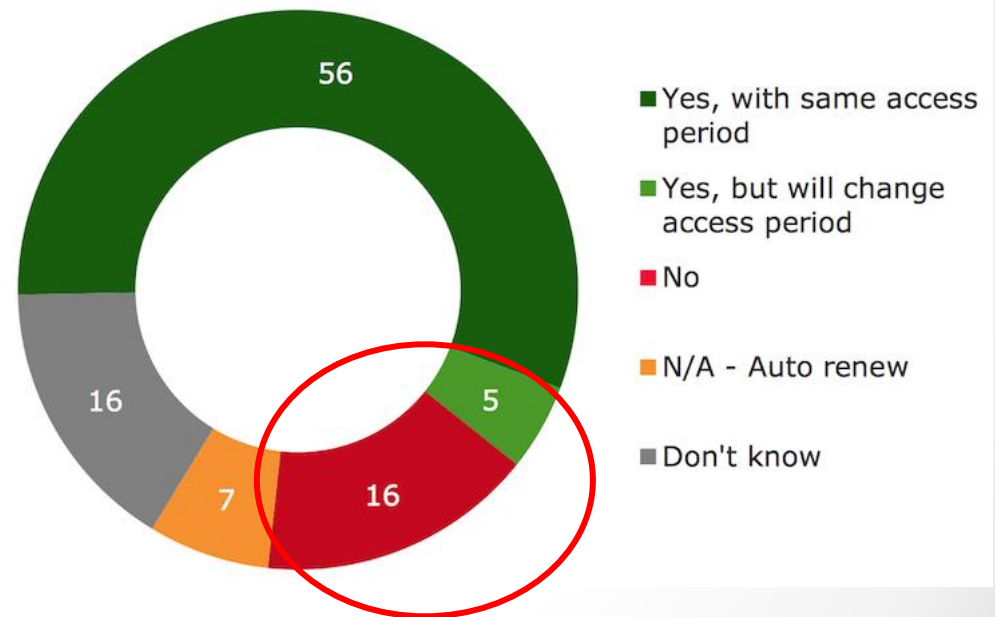
theguardian.com, Monday 7 January 2013 09.48 EST

[Jump to comments \(88\)](#)



TfL says the fee increases are the first since the scheme was introduced in July 2010 and will be used to improve it. Photograph: Dominic Lipinski/PA

Cyclists have expressed their disappointment at the 100% price rise in the cost of hiring London's "Boris bikes" – just months after the British cycling team's Olympic triumphs.



We assumed that the New York market was similar, so three price points were determined to develop a demand curve.

NEW YORK POST

Schumer devises tax break to rescue failing Citi Bike

By Geoff Earle

April 4, 2014 | 10:59am



| Price Point (Annual Pass) | Demand (with No Tax Break) | Demand (with Tax Break) |
|------------------------------|-------------------------------|----------------------------|
| \$ 95 | 100,000 | 107,350 |
| \$ 165 | 84,526 | 90,739 |
| \$ 235 | 55,789 | 59,890 |



Solver:

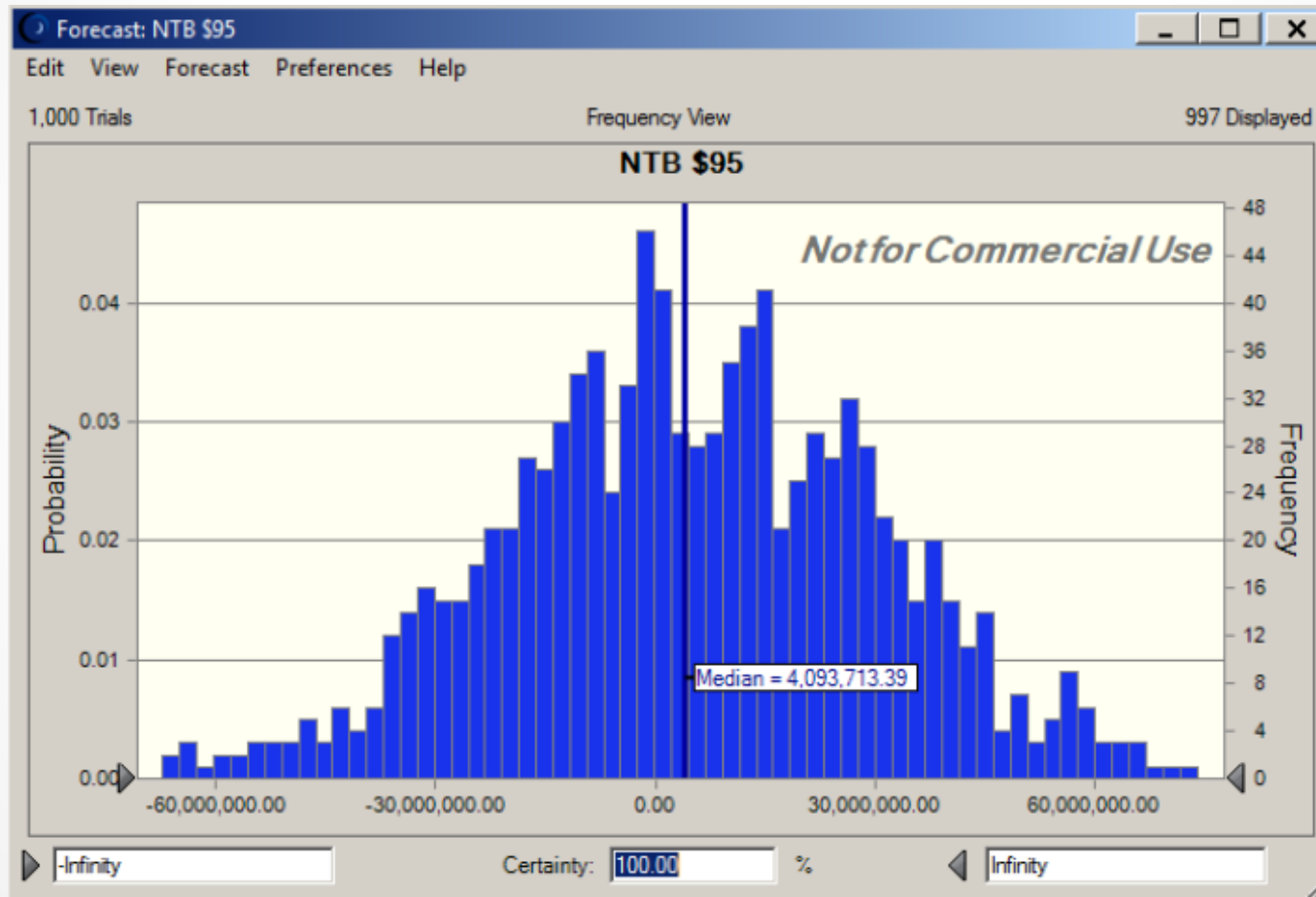
**What is the optimal price for
annual membership?**

A decision model was created based on Citi Bike's financials for the previous twelve months.

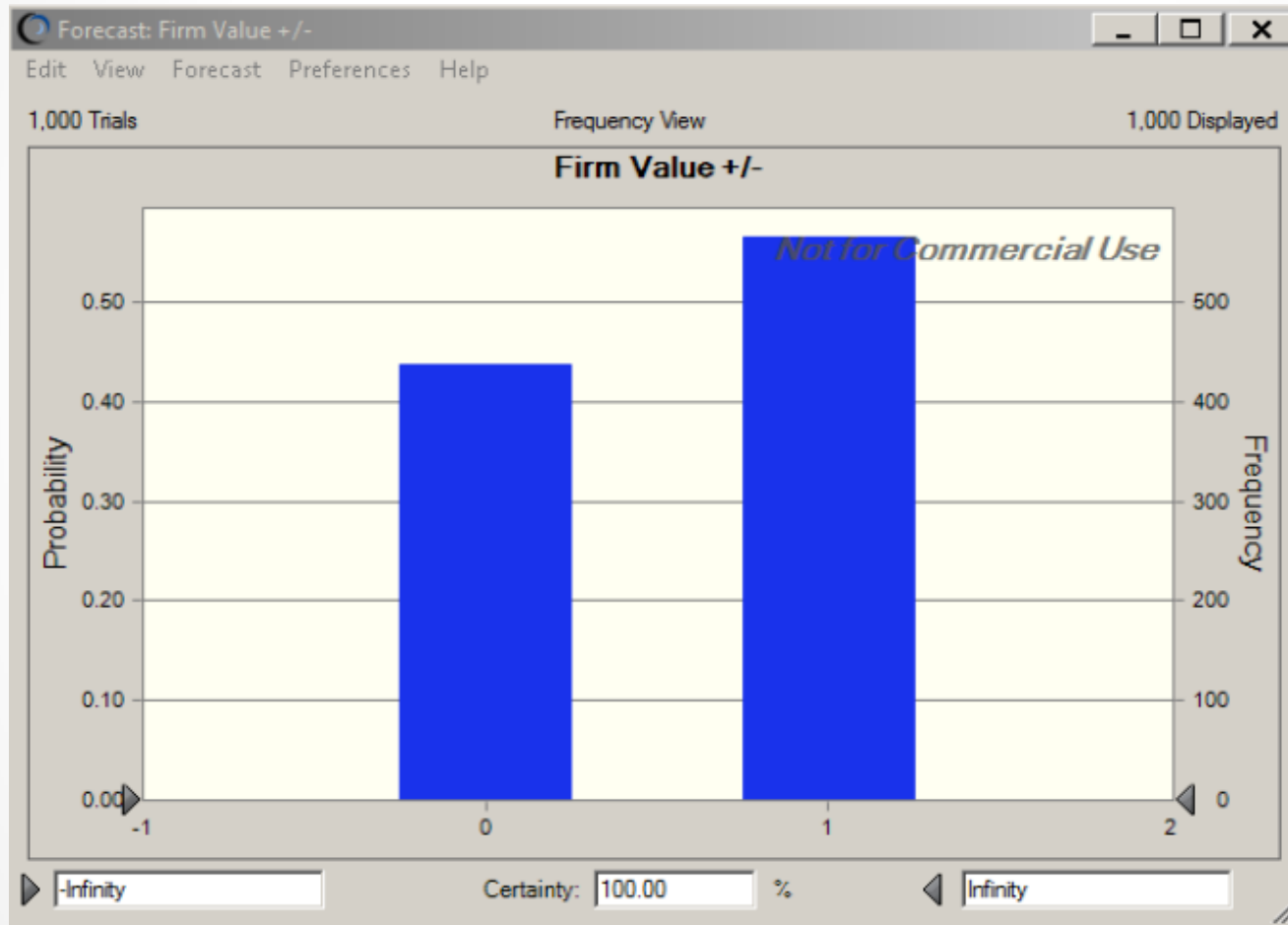
| Income Statement Model | Y1 | Y2 | Y3 | Y4 | Y5 |
|---------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Revenue | 24,355,000 | 24,935,650 | 25,533,720 | 26,149,731 | 26,784,223 |
| Memberships | 16,825,000 | 17,329,750 | 17,849,643 | 18,385,132 | 18,936,686 |
| Overage Fees | 2,530,000 | 2,605,900 | 2,684,077 | 2,764,599 | 2,847,537 |
| Sponsorship | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| Expenses | 20,895,469 | 21,493,533 | 22,109,539 | 22,744,025 | 23,397,546 |
| Bicycle Repair | 2,490,469 | 2,565,183 | 2,642,138 | 2,721,402 | 2,803,045 |
| Station Maintenance | 1,650,000 | 1,699,500 | 1,750,485 | 1,803,000 | 1,857,090 |
| Call Center | 840,000 | 865,200 | 891,156 | 917,891 | 945,427 |
| Web Maintenance | 100,000 | 103,000 | 106,090 | 109,273 | 112,551 |
| Salaries | 9,000,000 | 9,270,000 | 9,548,100 | 9,834,543 | 10,129,579 |
| Snow Removal | 1,155,000 | 1,189,650 | 1,225,340 | 1,262,100 | 1,299,963 |
| Rent and Utilities | 700,000 | 721,000 | 742,630 | 764,909 | 787,856 |
| Station License Fees | 3,300,000 | 3,399,000 | 3,500,970 | 3,605,999 | 3,714,179 |
| Marketing | 500,000 | 515,000 | 530,450 | 546,364 | 562,754 |
| Legal | 100,000 | 103,000 | 106,090 | 109,273 | 112,551 |
| Insurance | 100,000 | 103,000 | 106,090 | 109,273 | 112,551 |
| Depreciation | 960,000 | 960,000 | 960,000 | 960,000 | 960,000 |
| NIBT | 3,459,531 | 3,442,117 | 3,424,181 | 3,405,706 | 3,386,677 |
| Tax Rate | 40% | 40% | 40% | 40% | 40% |
| Tax Paid | 1,383,813 | 1,376,847 | 1,369,672 | 1,362,282 | 1,354,671 |
| NIAT | 2,075,719 | 2,065,270 | 2,054,508 | 2,043,424 | 2,032,006 |
| Free Cash Flow | 4,419,531 | 4,402,117 | 4,384,181 | 4,365,706 | 4,346,677 |
| Terminal Value Based on Exit Multiple | | | | | 31,513,410 |
| Firm Value | 53,431,623 | | | | |



The frequency distributions show estimated NPV under each scenario (for 1,000 trials).



We considered the price for annual membership, tax break options, and firm value (0 means – NPV, 1 means + NPV)



The median firm value was calculated based on three price points, with and without tax breaks.

| Tax Break | Price | Median Firm Value | Prob(Negative NPV) |
|-----------|-------|-------------------|--------------------|
| No | \$95 | \$4.1M | 0.43 |
| No | \$165 | \$63.8M | 0.04 |
| No | \$235 | \$54.5M | 0.06 |
| Yes | \$95 | \$12.6M | 0.30 |
| Yes | \$165 | \$76.4M | 0.02 |
| Yes | \$235 | \$65.2M | 0.05 |



The optimal price is a \$165 annual membership price, shy of the \$140 proposed.

| Tax Break | Price | Median Firm Value | Prob of Neg NPV |
|-----------|--------------|-------------------|-----------------|
| N | \$95 | \$4.1M | 0.43 |
| N | \$165 | \$63.8M | 0.04 |
| N | \$235 | \$54.5M | 0.06 |
| Y | \$95 | \$12.6M | 0.30 |
| Y | \$165 | \$76.4M | 0.02 |
| Y | \$235 | \$65.2M | 0.05 |



We recommend that Citi Bike charge between \$165-\$235 for annual membership in order to maximize profit.

Optimal Price is between \$165-\$235

However, the proposed price increase from Citi Bike is \$140 – lower than an optimal price given our demand curve

Why charge less than suboptimal price?

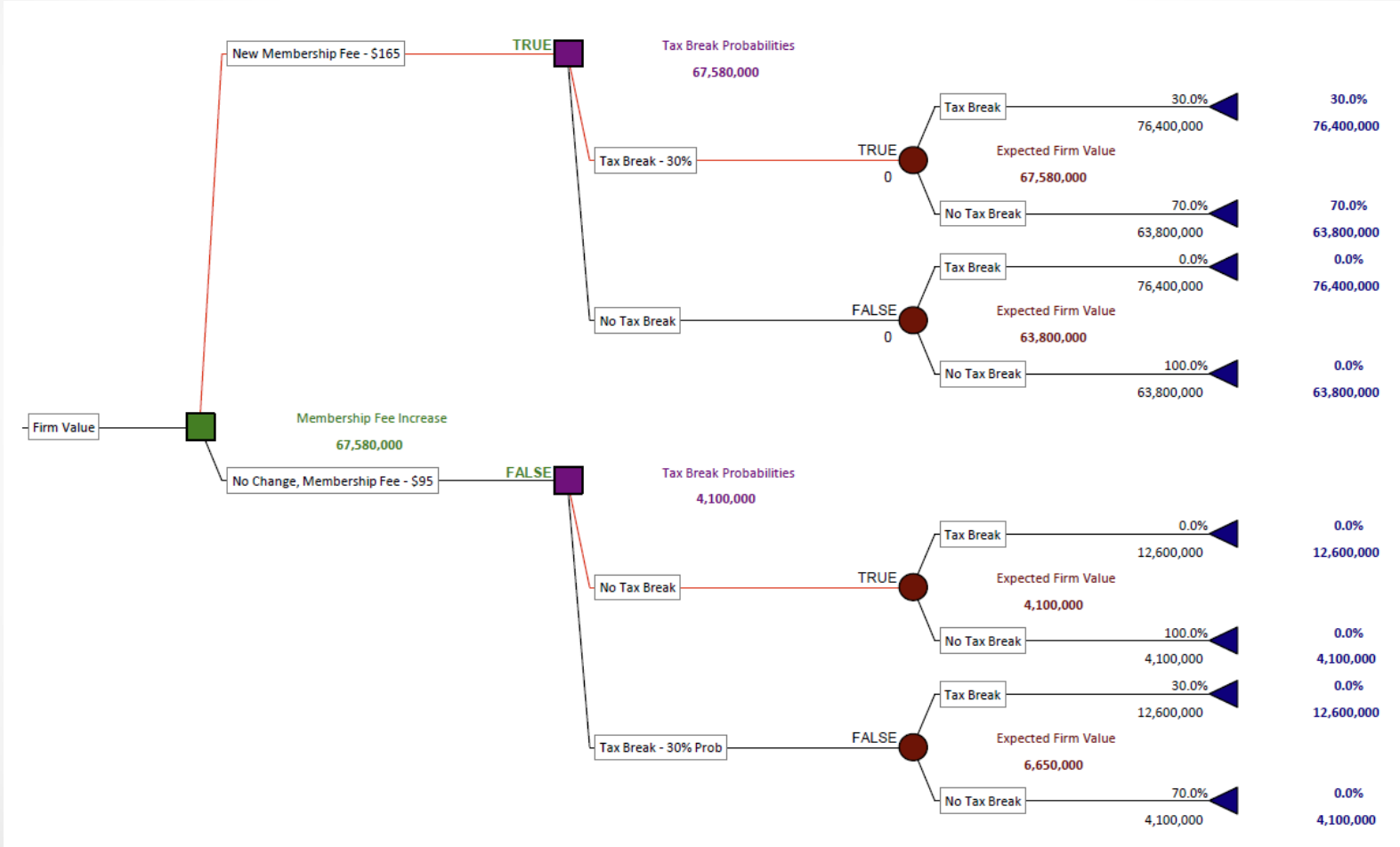
- Volume over margin
 - Lower price ensures widespread adoption in the long-run
- Not-for-profit
 - Raising additional \$45 per annual member ensures break-even
- Customer Psychology
 - Sticker shock less at \$140 vs. \$165+
- Differing Assumptions
 - Demand curve is steeper than assumed



Precision Tree on Tax Break Bill:

**What are the base-case
and worse-case scenarios?**

Precision Tree was used to show expected probabilities from three membership fees, with and without a tax option.



The optimal membership fee is \$165 and Citi Bike is worth \$67 million today.

| Annual Membership Fee | Tax Break Probability | Firm Value With Tax Break | Firm Value With No Tax Break | Expected Firm Value |
|-----------------------|-----------------------|---------------------------|------------------------------|---------------------|
| \$95 | 0% | \$12,600,000 | \$4,100,000 | \$4,100,000 |
| \$95 | 20% | \$12,600,000 | \$4,100,000 | \$5,800,000 |
| \$95 | 30% | \$12,600,000 | \$4,100,000 | \$6,650,000 |
| \$165 | 0% | \$76,400,000 | \$63,800,000 | \$63,800,000 |
| \$165 | 20% | \$76,400,000 | \$63,800,000 | \$66,320,000 |
| \$165 | 30% | \$76,400,000 | \$63,800,000 | \$67,580,000 |
| \$235 | 0% | \$65,200,000 | \$54,500,000 | \$54,500,000 |
| \$235 | 20% | \$65,200,000 | \$54,500,000 | \$56,640,000 |
| \$235 | 30% | \$65,200,000 | \$54,500,000 | \$57,710,000 |



Key Takeaways

- Citi Bike can overcome financial problems and show a net profit by raising prices.
- The annual membership fee should be increased from \$95 to at least \$165.
- The likelihood of a tax break is highest when the annual membership fee is priced between \$165 and \$235.
- The company is worth \$67.6 million today.



Questions?



Appendix

Crystal Ball Simulation

2014 04 25 Citi Bike IS Model (Draft) - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Crystal Ball Team SolverTable

E14 fx =Model!\$B\$95

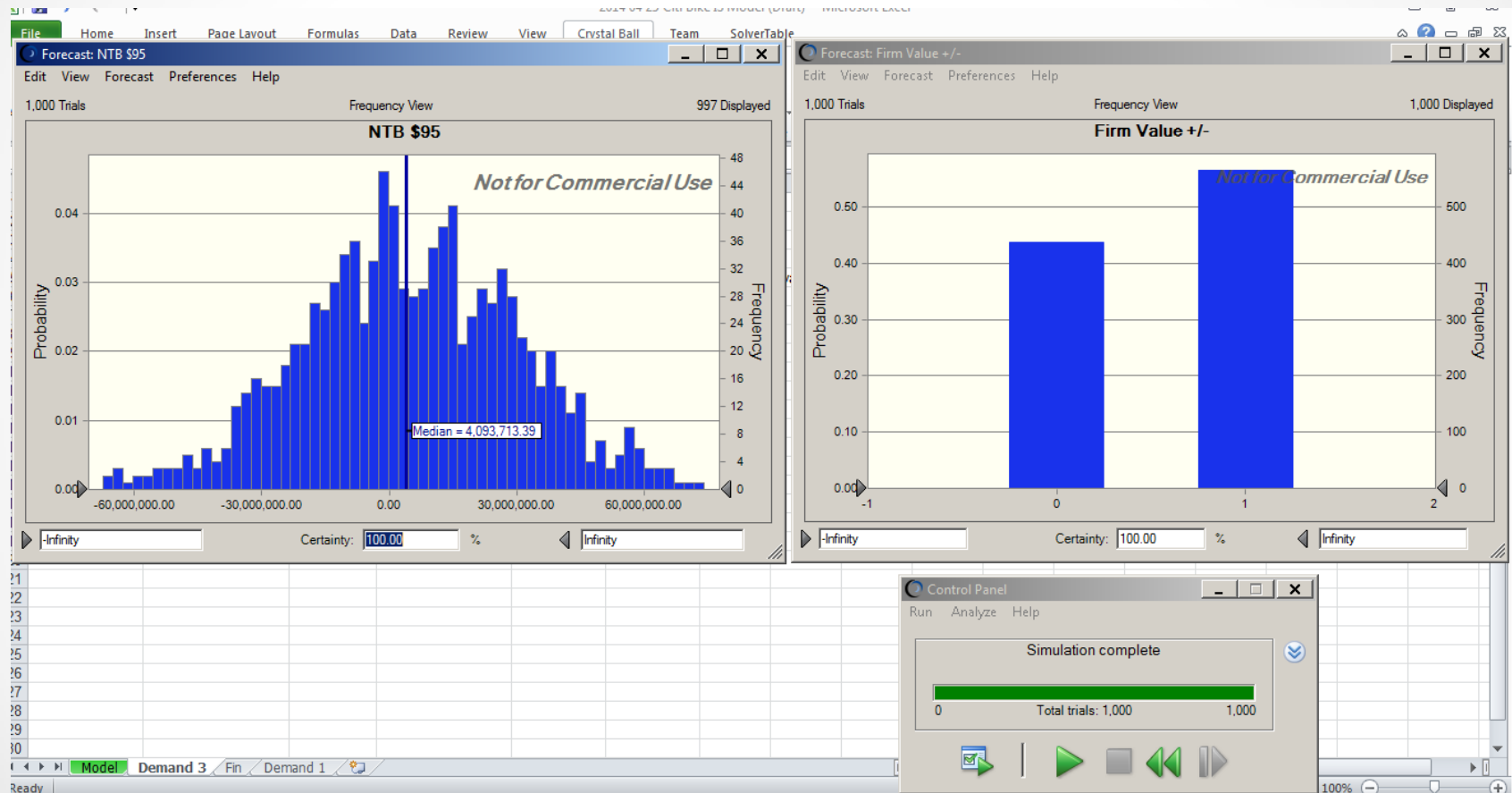
| | A | B | C | D | E | F | G | H | I |
|----|--------------|-----------------|----------|------------------|------------|----------------|-----------------------------|---|---|
| 1 | | | | | | | | | |
| 2 | No Tax Break | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | Price | Est Mean Demand | Std Dev | Simulated Demand | Firm Value | Firm Value +/- | | | |
| 5 | 95 | 100,000 | 20,000.0 | 0 | -122642856 | 0 | Change firm value each time | | |
| 6 | 165 | 84,526 | 16,905.3 | 0 | -122642856 | 0 | | | |
| 7 | 235 | 55,789 | 11,157.9 | 0 | -122642856 | 0 | | | |
| 8 | | | | | | | | | |
| 9 | Tax Break | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | Price | Est Mean Demand | Std Dev | Simulated Demand | Firm Value | | | | |
| 12 | 95 | 107,350 | 21,470.0 | 0 | -122642856 | 0 | | | |
| 13 | 165 | 90,739 | 18,147.8 | 0 | -122642856 | 0 | | | |
| 14 | 235 | 59,890 | 11,978.0 | 0 | -122642856 | 0 | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |
| 17 | | | | | | | | | |

Model Demand 3 / Fin Demand 1

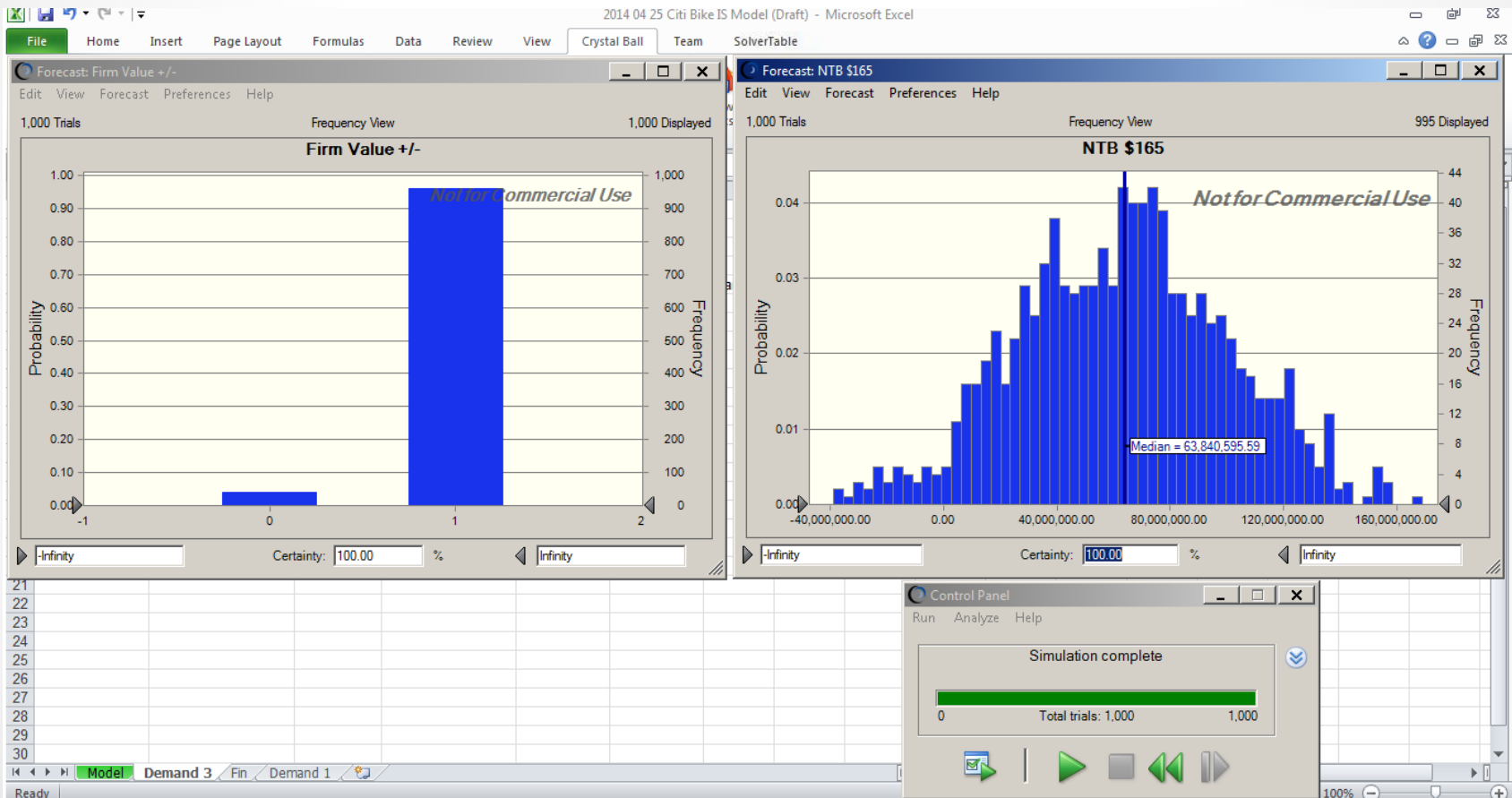
Ready 100%



Crystal Ball Simulation



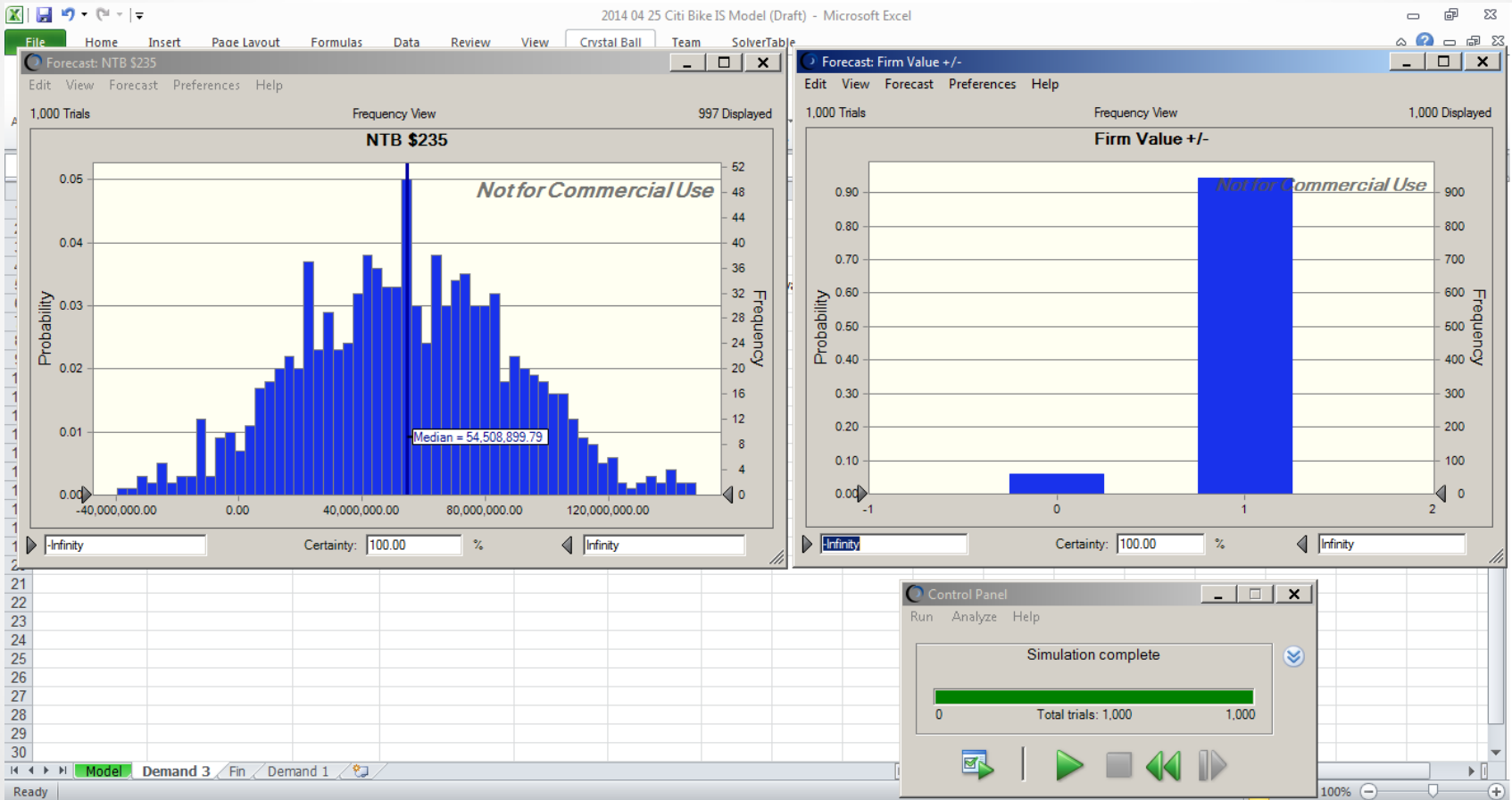
Crystal Ball Simulation



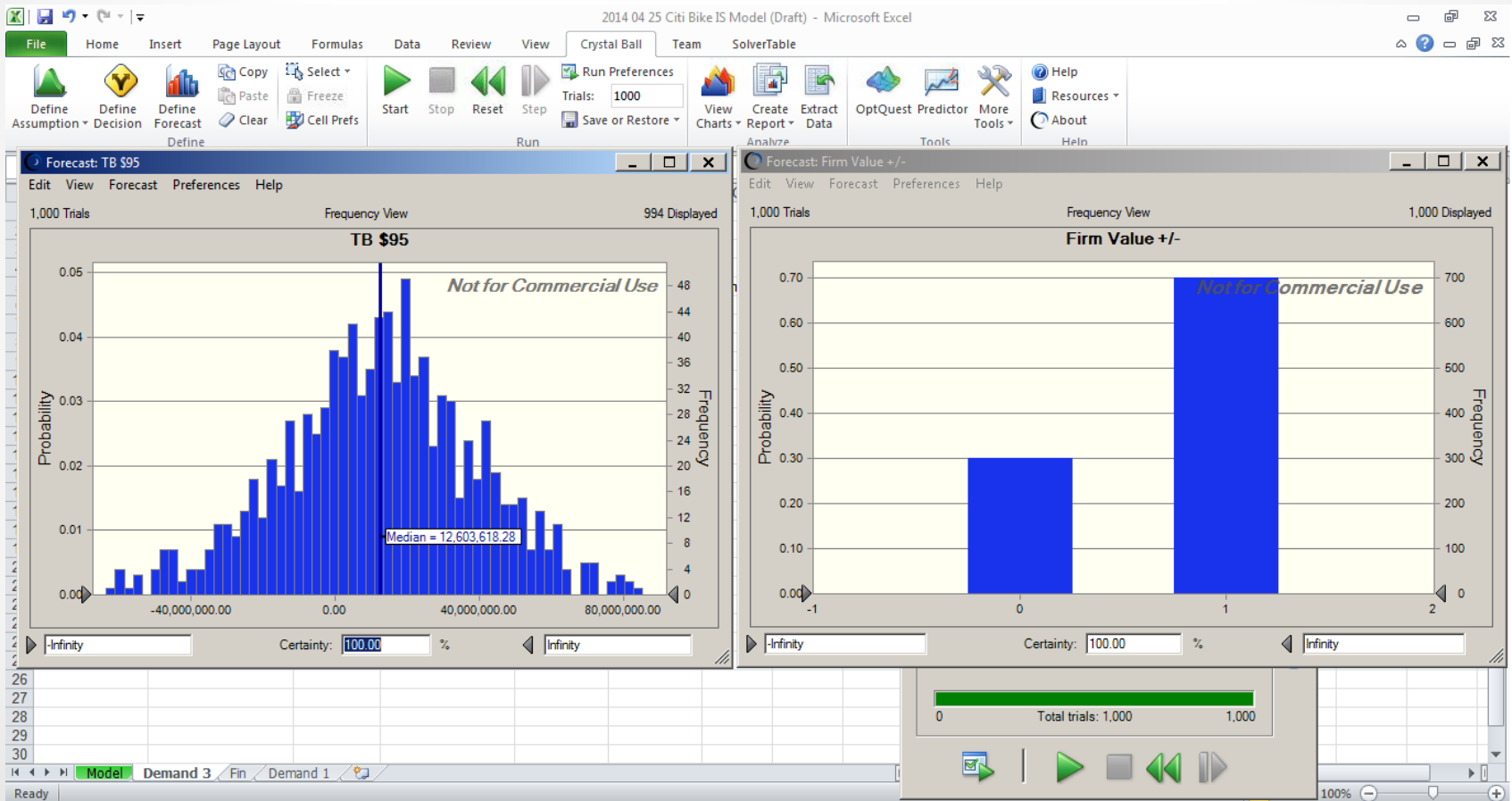
Agenda | Background | Assumptions | Solver | Precision Tree | Conclusion | **Appendix**



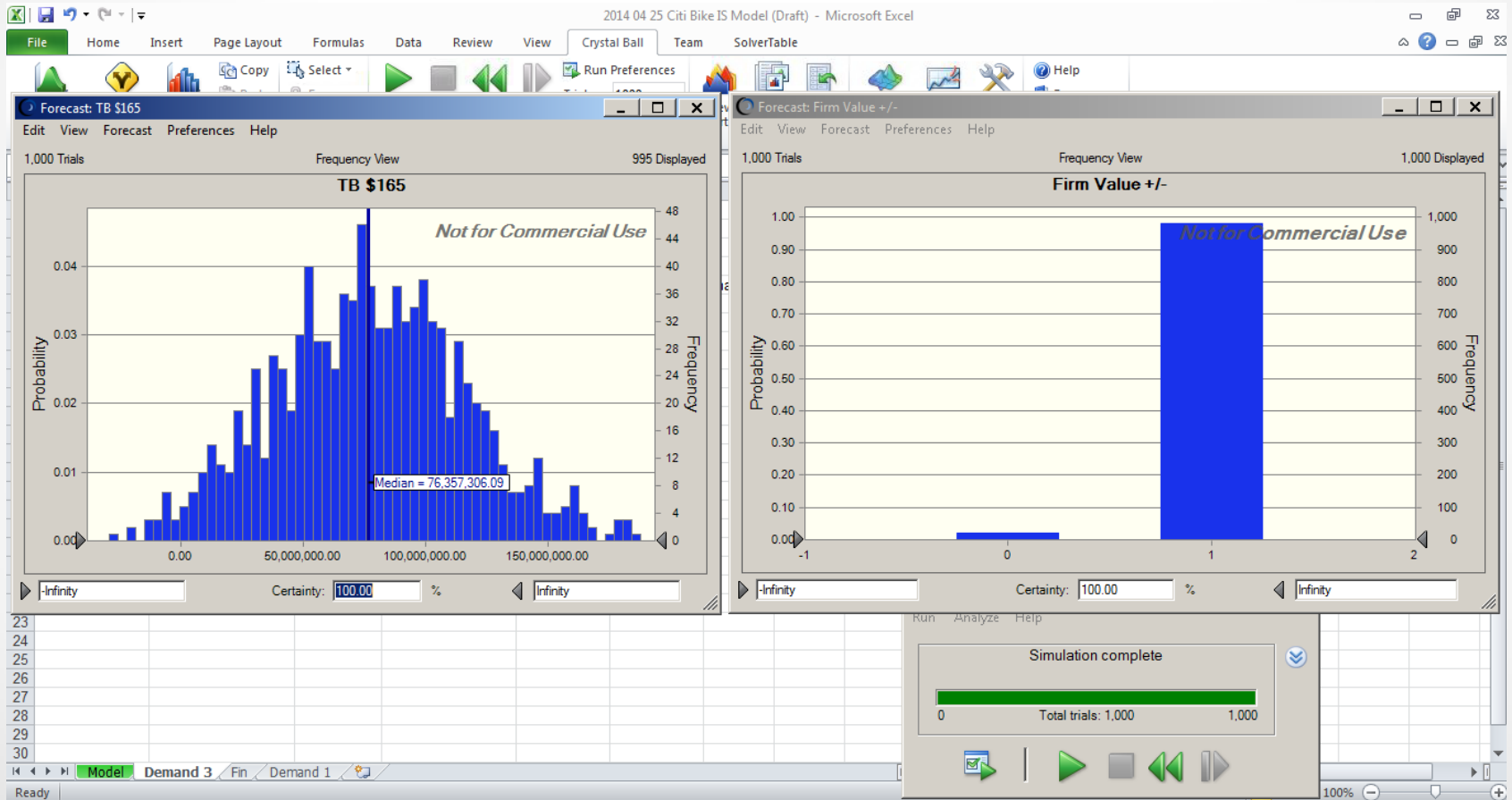
Crystal Ball Simulation



Crystal Ball Simulation



Crystal Ball Simulation



Crystal Ball Simulation

