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New York City Department of Parks and Recreation

Teaching Note

Synopsis

In January 2013, John C. Liu, New York City's comptroller, wrote to the residents of the city about his audit of the New York City Department of Parks and Recreation (DPR).[1] Liu summarized his office's findings: "The audit found that DPR was not carrying out and overseeing capital construction projects in a timely and cost effective manner."[2]

To investigate the existence of the planning fallacy in organizations, information from nearly 1,800 DPR capital projects undertaken between 1998 and 2008 was obtained from the office of the chief engineer of the DPR. This dataset includes various variables characterizing the projects, but most importantly, it contains estimates for the costs and durations of the projects along with realizations. Students can explore and analyze the data to order to determine how severely DPR suffers from the planning fallacy. Are there certain project characteristics (e.g., locations or teams) that are especially poor at estimation? Are there certain remedies that should be proposed based on the analysis?

Objectives

This case focuses on the challenges associated with developing accurate project goals and plans. It provides an opportunity for students to explore some psychological and organizational reasons for why project estimation is notoriously hard. The purpose of this case is to introduce the notion of a systematic planning fallacy and optimism bias in project estimation and to allow students to consider how it might manifest itself in public and private corporate settings. The case also highlights the power of data collection and utilizing project analytics. Through the analysis and case discussion, reference class forecasting (i.e., outside view) can be motivated and demonstrated.

An instructor can provide students with UVA-QA-0815X, a spreadsheet containing the data from the 1,800 projects. Using this rich public dataset and robust statistical methods, students will learn how firms can analyze their estimation and calibration capabilities. Students will be encouraged to generate implementable solutions for improving estimates and reducing the severity of the phenomenon. An instructor also has the option to use

[1] John C. Liu, "Audit Report on the Department of Parks and Recreation's Oversight of Capital Projects," January 11, 2013, http://comptroller.nyc.gov/wp-content/uploads/documents/7E12_067A.pdf (accessed August 29, 2013).
[2] http://comptroller.nyc.gov/wp-content/uploads/documents/7E12_067A.pdf.

the case to demonstrate the power of pivot tables, linear regression, transformations, overconfidence, the wisdom of crowds, chasing the expert, and bracketing.

Purpose and Context

This case is intended for use in an MBA elective on project management. It can be used at the start of the course, to set the scene around the challenges of estimating, planning, and executing projects, or toward the end of a module on project risk analysis. Either way, the case and class are useful in providing an alternative (statistical) approach to project estimation, which can be contrasted with a more bottom-up approach such as the critical path method typically used in project settings.

In addition, the case can be useful in a decision-analysis or statistics course when discussing estimation and subjective forecasting. The case provides an excellent introduction and stimulates discussion of various accuracy measures and methods for improving accuracy over time.

Supplemental Materials

Student spreadsheet: UVA-QA-0815X

Faculty spreadsheet: UVA-QA-0815TNX

Student Assignments

Read these articles:

- Dan Lovallo and Daniel Kahneman, "Delusions of Success: How Optimism Undermines Executives' Decisions," *Harvard Business Review* (July 2003): 56–63.
- John C. Liu, "Audit Report on the Department of Parks and Recreation's Oversight of Capital Projects," January 11, 2013, http://comptroller.nyc.gov/wp-content/uploads/documents/7E12_067A.pdf (accessed Jul. 29, 2015).

Answer the following questions:

1. Using the data provided in the case, investigate the existence of the planning fallacy at the DPR. Specifically, how accurate has the department's cost estimation been? How about its ability to meet set deadlines?
2. Given your analysis of the data, what would you recommend for DPR as areas for improvement with respect to project planning and control?

Analysis

A starting point would be to examine whether or not DPR suffered from the planning fallacy during 1998 to 2008. Given the data, the following descriptive statistics (**Table 1**, **Table 2**, and **Table 3**) might be helpful:

Table 1. Descriptive statistics.

	Mean	Standard Deviation	Median
Late (days)	78.2	190.64	44
Cost escalation (%)	44%	1.13	30%

Source: All tables created by case writer.

Table 2. Summary of on-time completion.

	Duration	
	Count	Percentage
Early	576	32%
On time	113	6%
Late	1101	62%

Table 3. Summary of on-budget completion.

	Cost	
	Count	Percentage
Under budget	131	7%
Over budget	1659	93%

Indeed, it seems that DPR does exhibit some degree of planning fallacy—too often, it is either late or it runs over budget (see corresponding histograms in **Exhibit TN1**). Additional analysis such as text analysis, keyword search, and pivot tables might be helpful for identifying general tendencies. The questions students should explore is whether there are specific project characteristics that seem more likely to suffer from the planning fallacy and from related inaccuracies. **Exhibit TN2** provides word clouds which can be used to highlight keywords most often associated with early- or late-completed project and with under- or over-budget projects. **Exhibit TN3** demonstrates how a pivot table might be useful for identifying areas of inefficiency and mismanaged projects.

Ultimately, stepwise regressions can be used to identify the statistically significant attributes. Consider the following two regression models:

- Days Late = log (Cost) + 93.4 × Electrical + 77 × Brooklyn Team + 86.3 × Manhattan Team + 105 × Staten Island Team − 108 × Tree Planting
- Cost Escalation = log(Cost) + 0.19 × Construction + 0.58 × Electrical + 0.17 × Queens Team + 0.18 × Manhattan Team − 0.22 × Tree Planting

In these models, all factors are significant for determining the degree of inaccuracy.

Pedagogy and Class Discussion

1. *Given your analysis of the data, does DPR suffer from the planning fallacy?*

Most students will say "Yes!" Ask for more explanations as to why they believe this. The notion of accuracy of estimates should come up, as will ideas around reporting and incentives. Try to capture their main thoughts on the board at a high level, and try not to spend too much on the specific analysis each student conducts; there will be plenty of time later. The main focus at the start should be the high-level descriptive statistics, the histograms (as depicted in **Exhibit TN1**), and the answers to the second question.

2. *How will we measure accuracy?*

Allow for a discussion to emerge as to how we are going to measure deviation from set targets. Among the potential proposals are the following:

- Absolute percentage error: |Forecast − Actual|/Actual
- Relative percentage error: (referred to as cost escalation in project estimation literature): |Forecast − Actual|/Forecast:
- Ratios: Forecast/Actual or Actual/Forecast
- Difference: Actual − Forecast
- Days delayed (only the positive differences)
- Absolute error: |Forecast − Actual|
- Squared error: (Forecast − Actual)^2

Once the desired accuracy measure has been proposed, review the summary statistics and any corresponding histograms. Consider how different accuracy measures might tell a different story. Try to get students to articulate why some measures might not be relevant here and why others might be crucial (given the type of decisions that are being made in this context and setting).

3. Why does this happen? What are some causes of the planning fallacy?

A rich conversation will emerge concerning the reasons why the planning fallacy occurs. Some will quote reasons mentioned in the *Harvard Business Review* article.[3] These have to do mainly with cognitive biases:

a. Overconfidence
b. Optimism
c. Anchoring
d. Student syndrome: (or procrastination)
e. Parkinson's Law: "work always expands to fill allotted time"

If students haven't experienced the overconfidence exercise, or any of the other biases, this would be a good opportunity to demonstrate the biases with a set of exercises (time permitting). It is important, however, to allow for another list to emerge, one that has to do with organizational challenges:

a. Incentives
b. Project and organization complexity
c. Winner's curse and contract bidding ("foot-in-the-door")

4. Can the data suggest any way to overcome the planning fallacy?

Allow students to show their proposals and models. The students will want to showcase their analysis. Many will have used pivot tables to slice the data in interesting ways, and some will use regressions with dummy variables.

Some key points should emerge:

- DPR exhibits strong planning fallacy.

[3] Lovallo and Kahneman, 2003.

- Certain project attributes lead to faulty parameter estimation when the fallacy does occur.
- Size (money).
- Type of project.
- Construction unit.
- New features can be introduced: e.g., experience of team (using frequency in dataset).

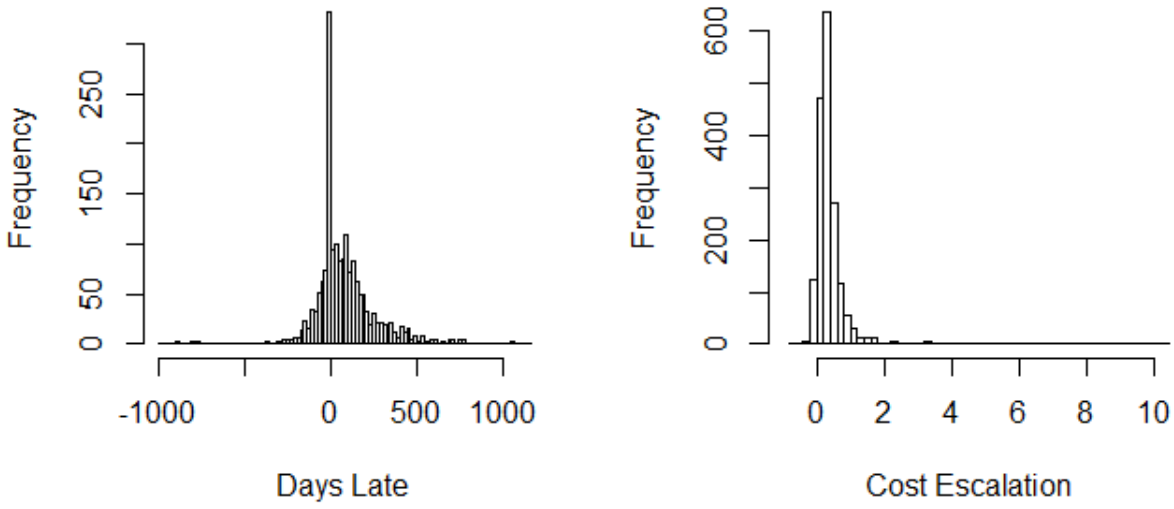
5. *Have students had experience with using such an outside view in their organizations?*

Conclude by showing some examples: e.g., HM Treasury, "Optimism Bias," HMT Green Book: Supplementary Guidance, April 21, 2013, https://www.gov.uk/government/publications/green-book-supplementary-guidance-optimism-bias (accessed Jul. 29, 2015).

Exhibit TN1

New York City Department of Parks and Recreation

Histograms of Days Late and Cost Escalations across All Projects



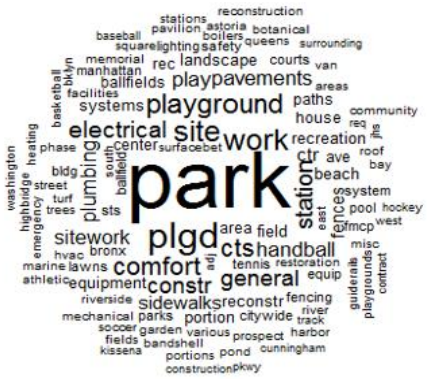
Source: All exhibits created by case writer.

Exhibit TN2

New York City Department of Parks and Recreation

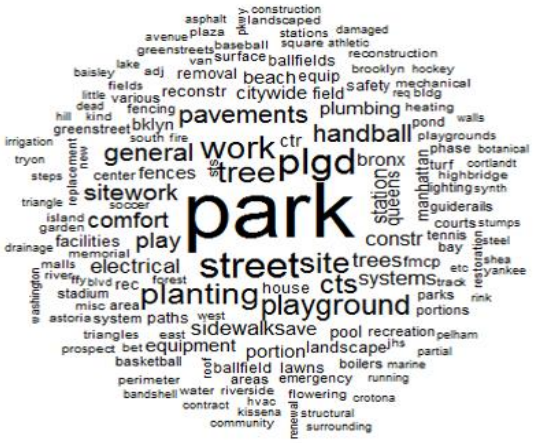
Using Text Analysis to Identify a Reference Class

Late



Not Late

Over Budget



Not Over Budget

Exhibit TN3

New York City Department of Parks and Recreation

Identifying Reference Class

Team	Average Days Late
Architecture	729.0
Construction Resources	303.0
Staten Island Team	205.0
Manhattan Team	139.6
Brooklyn Team	131.1

Team	Average Cost Escalation
Technical Services (Randalls Island)	70%
Manhattan Team	67%
Environmental Control Unit	66%
Queens Team	60%
Bronx Team	46%

	Electrical	Tree	Landscape	Plumbing	Park	Station	Playground
Count	106	270	58	91	570	118	354
Average Cost Escalation	62%	20%	49%	10%	53%	74%	37%
Average Duration Overrun	172.2	−45.6	138.7	178	115	138	95.5