A brief history of ORF 411

■ 1970’s up to 1977
  » Harvard business school case studies-style course taught by Howard Menand, director of the “Basic Engineering Program.”

  » “Case studies with linear programming” taught by Prof. Mulvey

  » Prof. Powell’s unsuccessful attempt at teaching case studies

  » Attempt to give the course an application setting, using classical material from operations management.
  » Developed an operations planning game oriented around production and inventory

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A brief history of ORF 411

- **1997- 1999 Operations Engineering**
  - Course took on the theme of “resource allocation” with many applications
  - Introduced the Orange Juice Game, with more emphasis on strategic planning

- **2000- Operations and Information Engineering**
  - Continued evolution of the course to emphasize the role of information
  - Began multi-year development of the theme of “information engineering”
  - Major themes of modeling, and making decisions under uncertainty.
A brief history of ORF 411

The mission of ORF 411

» To serve as the capstone course for ORFE, integrating statistics, probability/stochastic processes, and optimization.
» To develop skills in modeling, to translate real-world problems into mathematics to create the foundation for formal analysis.
» To learn how to deal with the evolution of information, both passively and actively.
» To learn how to work in teams to solve large, complex problems that require multidisciplinary strategies.

» … and to have fun!
Lecture outline

- Course organization
- What is resource management?
- The case for a fundamental model
- Modeling
- The orange juice game
Course organization

- Lectures
  » Outline slides
  » The header
    • Tells where we are in the lecture
Course organization

- Lectures
  - Power point presentations
    - Reduced note taking (and more thinking!)
    - Enhanced graphics
Course organization

Lecture notes:

» They will be available on the course web page at the end of each week.

» These notes are your “textbook.” Everything on problem sets and the midterm are in the powerpoint slides.

» Some classes are taught entirely from powerpoint; for others, we will use the blackboard with the powerpoint slides as a reference.
Course organization

■ Grading
  » Homeworaks and class attendance/participation (20%)
  » Midterm exam (30%)
  » The orange juice game
    • Description of your OJ enterprise model (15%)
    • How well your team performed (20%)
    • Team evaluations (15%)

■ Readings
  » Selected readings downloadable from Blackboard
  » Lectures and PowerPoint slides
Course organization

■ TAs:
  » Daniel Jiang <drjiang@princeton.edu>.
  » Genna Gliner <genna@princeton.edu>

■ My availability
  » Usually afternoons
    • Office: Rm 230
    • CASTLE Lab: Rm 110 (look for me here first).
  » Email: powell@princeton.edu. *Please be sure “ORF 411” is in the subject heading.*
  » Appointments: by email

■ For more information:
  » See Blackboard on the university web site.
  » Email homework questions to the TA’s.
  » Email OJ game questions to Prof. Simao <hpsimao@princeton.edu>
  » Email Prof. Powell with any other questions
Course organization

- Classes:
  » We start at 11am. Not 11:05 or 11:10. Arriving late to class disrupts the lectures and your classmates who arrive on time.

  » Keep it lively! Questions, comments and criticisms are welcome. Don’t be shy! People do not care how much you know, but how much they learn from you. And you are a hero when you ask the question that they wanted to ask but were too shy.
Course organization

- **Problem domain**
  - Management of physical, financial and informational resources
  - Understanding the organization and flow of information

- **Modeling**
  - A major theme of the course is the translation of real-world problems into mathematics.
  - Special emphasis on modeling decision problems in the presence of dynamic information processes.

- **Making decisions**
  - At the heart of every problem is the challenge of making a decision.
  - We develop the notion of designing good “policies” for making decisions.

- **The OJ game**
  - A team competition that develops the elements of solving a complex problem using a team.
Lecture outline

- Course organization
- What is resource management?
- The case for a fundamental model
- Modeling
- The orange juice game
NetJets created the concept of fractional jet ownership giving individuals and businesses all the benefits of whole aircraft ownership and more at a fraction of the cost.

390,000 flights annually.

EXPERIENCE

as defined by NetJets.
Control centers

- Control center at Netjets
  - Manages 700+ aircraft
  - 2,000 pilots
  - Responds to weather delays, equipment problems, changing customer requests

- Dispatch room at Schneider National
  - Manages 15,000 drivers
  - Pioneered satellite communication and real-time driver optimization
  - Balances real-time driver issues with global network balance
Schneider National
Electricity

- **2003 northeastern blackout**
  - Disabled communications, transportation, financial systems
  - Exposed vulnerability of modern society to the power grid.

- **2012 blackout in India**
  - Affected a population twice the size of the U.S.
  - Attributed to farmers pumping water in response to a drought.
  - The grid makes allocations, and operators were exceeding their allocations.
Electricity

Electricity as the new money?

Electricity as the universal basis for a new money system

"We cannot solve problems at the same level at which we created them." -- Albert Einstein

Eric Blair
Activist Post

A couple of weeks ago, a fresh idea for a new monetary system was quietly introduced that deserves more consideration. In fact, it’s an idea so profound that it could potentially solve some of the biggest problems facing human civilization. Increasingly the masses are becoming dreadfully aware that the current predatory monetary system is the greatest threat to human freedom, world peace, and environmental harmony, and must be abolished and replaced with something new.

The pioneering proposal is to create a monetary system based on electricity. Popular alternative news radio host and former NASA scientist, Michael Rivero, motivated by his knowledge and extreme displeasure of the current banking system, proposed the "Lectro": a universal currency based on one kilowatt hour of electricity. Rivero writes:

What is needed is a medium for exchange that increases in supply right alongside the population itself, in order to maintain stability and constant value.

So, my suggestion is to use electricity as the universal basis for a new value-based money system. For the purposes of discussion I call the new US monetary unit the "Lectro." It is redeemable for one kilowatt hour of electricity.
An energy generation portfolio
What is resource management?

- The supply chain
What is resource management?

- Amazon expands distribution network
  - As it loses its advantage from not charging sales tax, it is investing heavily in its distribution network.
  - Amazon would like to achieve same-day service for some metropolitan areas.
Global logistics
That’s Logistics: Without Tim Cook, iPad would cost $5,000

Before becoming the CEO of Apple last year, Tim Cook was known as the “logistics king” of the company. MacTrast.com pointed to an article on Business Insider that may demonstrate just how much: “If it weren’t for Tim Cook, the iPad would cost $5,000.”
Global logistics

Under Tim Cook’s tenure as head of logistics, Apple made the transition from a maker of expensive niche products to making the most popular single device in the history of humanity.

Cook was able to figure out logistics and manage the supply chain so Apple could earn those fat margins. This isn’t the first time we’ve heard people marvel at Cook’s operations ability, but it was the best phrasing for it we’ve ever heard. … The real reason Apple is the most valuable company in the world right now isn’t that it makes ultra-sexy iPads and iPhones. It’s because it makes ultra-sexy iPhones and iPads and charges the same price as its rivals, or less, for those gadgets.

Total iPhones Sold Worldwide
March 2011: 108 million
January 2011: 90 million
April 2010: 50 million
January 2010: 42.4 million
January 2009: 17.3 million
January 2008: 3.7 million

1st qtr, 2012:
37 million iPhones
4th qtr estimate:
41 million
Natural disasters

- The Fukushima tsunami
  - Knocked out nuclear power plant
  - Region was a hotbed of manufacturing.
  - Disrupted supply chains of products ranging from red paint to memory chips.
  - Shut down auto assembly plants in the U.S.
Electronic waste

» Guiyu, China processes 1.5 million pounds of electronic waste each year.

» China can break down components more cheaply because it lacks anti-pollution laws.

» Companies can simply dump waste product into rivers.

» As a result, Guiyu has the highest rate of cancer-causing dioxins.

» Children are found to suffer from lead poison.
Perspectives of resource management

- The New York Yankees
Perspectives of resource management

Player’s perspective
Perspectives of resource management

General manager’s perspective: how long should the contract be?
Energy usage management

- Chilled water management at Princeton University
  » Major issue is how much to store in chilled water tank
Energy usage management

- Real time spot prices

Green line is real-time (5 minute) electricity spot prices
What is resource management?
Energy resource allocation

• What is the right mix of energy technologies?
• How should the use of different energy resources be coordinated over space and time?
• What should my energy R&D portfolio look like?
• Should I invest in nuclear energy?
• What is the impact of a carbon tax?

Energy markets

• How should I hedge energy commodities?
• How do I price energy assets?
• What is the right price for energy futures?
Wind

30 days

1 year
Storage

Hydroelectric

Flywheels

Batteries

Ultracapacitors
Energy storage portfolios

- Designing a dynamic storage control policy for portfolios of storage devices.
Electricity spot prices

Average price ~ $50/megawatt-hour
Battery arbitrage

- Making money on volatility
  » Store energy when prices are low, discharge when prices are high.
Perspectives of resource management

- The Dow Jones Industrial average
Minimizing volatility through portfolios

Asset values

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Minimizing volatility through portfolios

One stock
Two stocks
Three stocks
Four stocks
Five stocks
SMART-ISO: Offshore wind study

- Mid-Atlantic Offshore Wind Integration and Transmission Study (U. Delaware & partners, funded by DOE)

- 29 offshore sub-blocks in 5 build-out scenarios:
  - 1: 8 GW
  - 2: 28 GW
  - 3: 40 GW
  - 4: 55 GW
  - 5: 78 GW
SMART-ISO: Offshore wind study

- Observed wind levels for 14-20 Oct 2010

[Graph showing wind levels by buildout blocks for the period 14-20 Oct 2010]
SMART-ISO: Offshore wind study

- Observed wind levels for **22-28 Jul 2010**

![Wind Levels by Buildout Blocks - 22-28 Jul 2010](image)
What is resource management?

- Agriculture
  - Wheat, pork bellies
  - Frozen OJ concentrate

- Electricity

- Fossil fuels
  - Coal
  - Oil
  - Natural gas

- Human capital
  - Scientists
  - Programmers
  - Managers

- Mineral
  - Gold, silver, copper
  - Rare earth minerals
Mineral resources

China restricts exports of rare earths

» China had been producing 97 percent of rare earths, needed in a wide range of high tech products.
» Result was a boom in rare earth stocks, although these have come back down (as of 2012).
Mineral resources

  - Mineral boom in Afghanistan
  - Similar mineral rushes are taking place in Australia and Africa
  - How should companies optimize extraction in the short run?
  - How should countries manage mineral resources over the long term?
Resource management in health

Weather

• Robust design of emergency response networks.
• Design of financial instruments to hedge against weather emergencies to protect individuals, companies and municipalities.
• Design of sensor networks and communication systems to manage responses to major weather events.

Disease

• Models of disease propagation for response planning.
• Management of medical personnel, equipment and vaccines to respond to a disease outbreak.
• Robust design of supply chains to mitigate the disruption of transportation systems.
Allocating funds to the HIV/AIDS crisis

» Investing in:
  • Condoms
  • Antitransmission drugs
  • Disease remediation
  • Information

» Timing
  • Big push versus slow and steady

» Geography
  • What areas are best candidates?
Resource management in information

- The resource:
  » The web page a customer sees when they log into their Netflix account.

- The challenge
  » What movies should be displayed to maximize rentals?
Resource management in information

Maximizing revenue from ad clicks

<table>
<thead>
<tr>
<th>Customer</th>
<th>$Daily ad budget</th>
<th>Key word</th>
</tr>
</thead>
<tbody>
<tr>
<td>General motors</td>
<td>$100,000</td>
<td>Car</td>
</tr>
<tr>
<td>Ford</td>
<td>$75,000</td>
<td>General Motors</td>
</tr>
<tr>
<td>ExxonMobil</td>
<td>$150,000</td>
<td>Ford</td>
</tr>
<tr>
<td>British Petroleum</td>
<td>$125,000</td>
<td>Oil prices</td>
</tr>
</tbody>
</table>

$1.15 $1 $1.10 $1.20 $1 $1.20 $1 $1 $1.10 $1 $1.10 $1 $1 $1.20 $1 $1 $1.10 $1 $1 $1.15 $1 $1  

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Resource management in information

Maximizing revenue from ad clicks

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</tr>
<tr>
<td>Ford</td>
<td>$75,000-$1.20</td>
<td>General Motors</td>
</tr>
<tr>
<td>ExxonMobil</td>
<td>$150,000</td>
<td>Ford</td>
</tr>
<tr>
<td>British Petroleum</td>
<td>$125,000</td>
<td>Oil prices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oil spill</td>
</tr>
</tbody>
</table>
Resource management in information

- Maximizing revenue from ad clicks
  - Imagine that there are more people who search on “car” early in the day.
  - Ford is willing to pay the most, so we may make more money in the short run by sending those customers to Ford’s website.
  - Now imagine that more people search on “Ford” in the evening.
  - If we emptied Ford’s budget for the day, then we do not get paid for the searches on “Ford” because no-one else is interested in “Ford” as a search term.
  - We would make more money if we sent customers to a variety of websites when they enter “car” so that we do not deplete the Ford ad budget.
Lecture outline

- Course organization
- What *is* resource management?
- The case for a fundamental model
- Modeling
- The orange juice game
The case for a fundamental framework
The case for a fundamental framework

Make product → Product types → Satisfy demand

Product demands:
- $D_1(\omega)$
- $D_2(\omega)$
- $D_3(\omega)$
- $D_4(\omega)$
- $D_5(\omega)$
- $D_6(\omega)$
- $D_7(\omega)$
- $D_8(\omega)$

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The case for a fundamental framework

Make investment → Investment options → Balance portfolio → Market returns

- $D_1(\omega)$
- $D_2(\omega)$
- $D_3(\omega)$
- $D_4(\omega)$
- $D_5(\omega)$
- $D_6(\omega)$
- $D_7(\omega)$
- $D_8(\omega)$
The case for a fundamental framework

- How much energy to store in a battery to handle the volatility of wind and spot prices to meet demands?
The case for a fundamental framework

- How much money should we hold in cash given variable market returns and interest rates to meet the needs of a business?

Stock prices

Bonds

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The case for a fundamental framework

- Why do we need a fundamental language for “resource allocation”? 
  - To separate cosmetic differences from real differences  
  - To allow us to learn from seemingly different problems  
  - To prepare us to solve a much broader range of problems  
  - To teach us how to ask the right questions about a problem
The case for a fundamental framework

- Elements of a resource allocation problem
  - What are the “resources” we are managing?
    - What is a resource?
  - What types of decisions are we making?
    - What to do?
    - How much?
  - What are the sources of randomness?
    - Normally distributed random variables
    - Heavy-tailed processes
    - Rare events
  - How does the system evolve over time?
  - How do we measure how well we are doing?
    - Average costs and revenues
    - Risks, metrics
Lecture outline

- Course organization
- What is resource management?
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Modeling

To solve problems in an analytical, quantitative way, we need to put it on the computer.

The first step in this process is modeling.

\[
\begin{align*}
\min_{\pi} & \mathbb{E} \sum_{t=0}^{T} C(S_t, X_t^\pi(S_t)) \\
x_t &= X_t^\pi(S_t) \in X_t \\
S_{t+1} &= S^M(S_t, x_t, W_{t+1})
\end{align*}
\]
Modeling

When you took statistics, a model might look like:

» Linear in the parameters

\[ Y = \theta_0 + \theta_1 X_1 + \theta_2 X_2 + \ldots + \theta_K X_K + \varepsilon \]

» Nonlinear in the parameters

\[ Y = \theta_0 X^{\theta_2} \]

» Elements of a statistical model
  • Independent variables/explanatory variables/covariates
  • Dependent variables/response variables
  • Error term/noise
  • Parameters to be estimated
Modeling

- When you took probability, you learned about

  » Random variables and distributions

  \[ f_X(x) = \frac{1}{\sqrt{2\pi\sigma}} e^{-\left(\frac{x-\mu}{\sigma}\right)^2} \quad P(X = i) = \frac{\lambda^i e^{-\lambda}}{i!} \]

  » Markov chains and stochastic processes

  \[ p_{ij} = \text{Prob}[S_{t+1} = j \mid S_t = i] \]
Modeling

When you took linear programming, you learned how to put problems into the format

\[ \min cx \]

\[ Ax = b \]

\[ x \geq 0 \]

» Elements of an optimization problem
  • Decision variable/vector
  • Objective function
  • Constraints
Modeling

In this course, you will learn that the core elements of a stochastic optimization problem are:

» State variables
  • What is the *state* of our system?

» Decision variables
  • How do we control our system?

» Exogenous information
  • What is random?

» Transition function
  • How does the system evolve over time?

» Objective function
  • How do we know how well we are doing?
Modeling

Example: Storing natural gas to take advantage of seasonal variations

\[ R_t = \text{Amount of natural gas in storage at time } t. \]
\[ x_t = \text{Amount of natural gas added to the storage (if >0) or amount withdrawn (if < 0)} \]
\[ p_t^s = \text{Spot price for selling gas at time } t \]
\[ p_t^p = \text{Purchase price at time } t \]
\[ \hat{p}_t^s = \text{Change in spot price between } t - 1 \text{ and } t \]
\[ \hat{p}_t^p = \text{Change in purchase price between } t - 1 \text{ and } t \]
Modeling

Modeling the natural gas storage problem:

» What is the state variable?
\[ S_t = \text{State of the system at time } t \]

» What is the decision variable?
\[ a_t = \text{Action (discrete)} \]
\[ x_t = \text{Decision (may be continuous and vector-valued)} \]

» What is the exogenous information?
\[ W_t = \text{Exogenous information} \]

» What is the transition function?
\[ S_{t+1} = S^M (S_t, x_t, W_{t+1}) \]

» What is the objective function?
\[ C(S_t, x_t) \quad \text{or} \quad C(S_t, x_t, W_{t+1}) \]
Modeling

How do we make decisions?

» We make decisions using \textit{policies} which are \textit{functions} \textit{that return a decision given the information in the state variable}.

» We may write our decision function using

\[
a_t = A^\pi(S_t)
\]

• or

\[
x_t = X^\pi(S_t)
\]
Modeling

- The two fundamental equations of dynamic systems

  » Making a decision

  \[ x_t = X^\pi (S_t) \]

  » Simulating the process

  \[ S_{t+1} = S^M (S_t, x_t, W_{t+1}) \]
Modeling

■ Major themes of the course

» Learn how to *think* about complex, dynamic problems. We are going to draw applications from the complex problems we are facing today, including
  • Energy
  • Health
  • Finance
  • Businesses

» Learn how to *model* them in simple, elegant mathematical notation.

» Learn how to make *decisions* using *policies* to control systems.

» Learn how to *work in teams* to solve complex problems.
Lecture outline

- Course organization
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Coke engineers orange juice

Coke engineers orange juice

Don’t let the name fool you. Coca-Cola’s (KO) Simply Orange juice is anything but pick, squeeze, and pour. That cold glass of 100 percent liquid sunshine on the breakfast table is the product of a sophisticated industrial juice complex. Satellite imagery, complicated data algorithms, even a juice pipeline are all part of the recipe. “You take Mother Nature and standardize it,” says Jim Horrisberger, director of procurement at Coke’s huge Auburndale (Fla.) juice packaging plant. “Mother Nature doesn’t like to be standardized.”

Coca-Cola, maker of the Minute Maid and Simply Orange brands, is using its balance sheet and distribution reach to methodically build a global juice machine. That includes the U.S., Coke’s largest market, accounting for one-third of its volume sold. PepsiCo (PEP), led by its Tropicana brand, commands a 40 percent volume share of the $4.6 billion U.S. market for not-from-concentrate juices, compared with 28 percent for Coke, according to Euromonitor. Globally, the market researcher says, Coke gets about $13 billion in revenue annually from pure juice and juice drinks. “You see them focusing on still beverages because that’s been outgrowing sparkling drinks for several years now,” says Thomas Mullarkey, an analyst for Morningstar (MORN) in Chicago.

At the core of Coke’s plan in the U.S. is 100 percent not-from-concentrate OJ, for which consumers are willing to pay as much as a 25 percent premium. Yet producing the beverage is far more complicated than bottling soft drinks. Juice production is full of variables, from weather to regional consumer preference, and Coke is trying to manage each from grove to glass.
In bucolic Auburndale, an hour south of Disney World, Coke has spent $114 million in recent years expanding its premier U.S. juice bottling plant, which it claims is the world’s largest. It’s here that Coke has perfected a top-secret methodology it calls Black Book to make sure consumers have consistent orange juice 12 months a year, even though the peak growing season lasts about three months. “We basically built a flight simulator for our juice business,” says Doug Bippert, Coke’s vice president of business acceleration.

Black Book isn’t really a secret formula. It’s an algorithm. Revenue Analytics consultant Bob Cross, architect of Coke’s juice model, also built the model Delta Air Lines (DAL) uses to maximize its revenue per mile flown. Orange juice, says Cross, “is definitely one of the most complex applications of business analytics. It requires analyzing up to 1 quintillion decision variables to consistently deliver the optimal blend, despite the whims of Mother Nature."

The Black Book model includes detailed data about the myriad flavors—more than 600 in all—that make up an orange, and consumer preferences. Those data are matched to a profile detailing acidity, sweetness, and other attributes of each batch of raw juice. The algorithm then tells Coke how to blend batches to replicate a certain

Another part of Black Book incorporates external factors such as weather patterns, expected crop yields, and cost pressures. This helps Coke plan so that supplies will be on hand as far ahead as 15 months. “If we have a hurricane or a freeze,” Bippert says, “we can quickly replan the business in 5 or 10 minutes just because we’ve mathematically modeled it.”

Coca-Cola bought Minute Maid in 1960. The juice company had been founded during World War II by pharmaceutical engineer Jack Fox, an expert at concentrating blood serum, to make OJ concentrate for a military contract. Today frozen orange juice from concentrate makes up less than 4 percent of the entire U.S. orange juice market, according to Coke, and is a tiny piece of Minute Maid sales. Instead the beverage giant has thrown its efforts into fresh juice, doubling global volume sales from 2004 to 2011. Of Coke’s 15 brands that each generate at least $1 billion in revenue annually, four are juice-based drinks: Minute Maid globally, Simply Orange in the U.S., Minute Maid Pulpy in Asia, and Del Valle in Latin America.

Coke accounted for 17 percent of the juice-related volume sold in the world’s top 22 markets, compared with 9 percent for PepsiCo, according to Nielsen (NLSN) data for the year ended last September. Coke’s market share
The OJ Game

-producing regions:
By Millie Munshi

Aug. 28 (Bloomberg) -- Orange-juice futures rose to the highest closing price since 1990 in New York on speculation that Tropical Storm Ernesto will damage crops in Florida, the world's second-largest producer of oranges.

Ernesto, moving over Cuba today, is projected to gain strength and have winds of as much as 95 miles per hour when it reaches southeastern Florida on Aug. 30, the National Hurricane Center said. Hurricane damage to citrus groves in 2004 and 2005 has led to a doubling of wholesale orange-juice prices in the past year.

Orange juice for November delivery rose 1.6 cents, or 0.9 percent, to $1.8645 a pound, the highest closing price for the most-active contract since July 17, 1990. Prices reached $1.876 on Aug. 17, also the highest since that date 16 years ago.

Inventories of frozen orange juice are a third less than a year ago, Scoville said. Florida crop damage similar to 2005 would "pretty much blow away whatever we have stored," he said.

Orange-juice inventories in Florida for the season are down 35 percent from a year ago at 80.4 million gallons, the state Department of Citrus reported Aug. 19. U.S. inventories were estimated at 1.002 billion pounds at the end of July, down from 1.502 billion a year earlier, the USDA said in a monthly report on Aug. 22.
Orange juice prices jump as Isaac may become hurricane


NEW YORK (Reuters) - New York orange juice futures jumped almost 6 percent on Wednesday after U.S. forecasters warned Tropical Storm Isaac would strengthen into a hurricane and could hit the south coast of citrus-rich Florida by Monday.

The National Hurricane Center said Isaac was strengthening in the Caribbean. Fears of damage to the country’s top citrus-growing region pushed benchmark November frozen concentrated orange juice on ICE Futures U.S. up 5.9 percent to settle at a six-week high of $1.222 per lb.

After finding resistance earlier in the day, juice futures punched through a 100-day moving average.

On Tuesday, the half-a-billion-dollar orange juice futures market rose as much as 8 percent when forecasters cautioned about the strengthening tropical storm.

(Price graphic: http://link.reuters.com/bav22t)

September prices settled up 6.5 percent at $1.391 per lb, a three-and-a-half-month high and almost limit up.

"This is all weather related. The path is looking like it’ll hit Florida for sure," said Bill Collard, who heads up Florida-based commodity brokerage firm the Futures Management Group.

Prices remained well below records of $2.2 per lb set in January when U.S. authorities restricted imports of Brazilian juice due to the use of a banned fungicide.

Traders said they expected prices to remain elevated unless the storm veers away from the Florida coast. Still, market fundamentals are sluggish amid waning global demand and plentiful supplies, they said.

"It probably should be going down because there’s enough supply. (But) November could run to $1.30 before it finds some strong resistance," Collard said.
The OJ Game

- Manufacturing:
The OJ Game

- Storage facilities
The OJ Game

Markets:
The OJ Game

- The OJ Game users manual:
  - Summarizes playing the game
  - Decisions spreadsheet
  - Analysis of history
The OJ Game

■ The setting

» “Mom and Pop” have been running this family-owned business for a generation. They have decided to retire in the face of mounting losses.

» You are the first professional management team to take over and run the company.

» You will get 10 years of historical data that will provide some background data on prices and markets.

» The challenge: to outperform the best talent in the country!
The OJ Game

- The decisions spreadsheet:
  - Teams control the running of the company for a year.
  - Separate tabs for decisions regarding:
    - Futures
    - Shipping to manufacturing
    - Size and location of manufacturing and storage
    - Shipping to storage
    - Pricing at markets
The OJ Game

- The game schedule (see detailed dates provided on web site)
  - Before fall break –
    - Team formation
    - Analyzing historical data
    - Developing team roles
  
  - Two practice rounds
    - First week after midterm
  
  - First four rounds
    - One per week before Christmas
  
  - The orange bowl
    - Second Monday of reading period (the day before dean’s date)
    - The orange bowl starts at 1pm, and we run 3-4 iterations (years) per hour for four hours.
The OJ Game

■ Rules of the game

» You may *not* use any information of any form from previous runs of the OJ game. If you have obtained information from a previous team, please contact me right away.

» You may not share information of any form with competing teams.

» Please, compete hard but honestly, and do your best to get along with your team. *This is an important part of your grade!*
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■ Team structure
  » Team lead – Chosen by Prof. Simao based on:
    • Application to be a team lead
    • Votes by your classmates
    • Your resume (and yes, we read every one)

  » Team members
    • Each team will evolve roles for the different team members.

■ Team formation
  » Based on the skills indicated in the questionnaire you are filling out today, and your resume.
  » Teams are formed to ensure a balance of skills and enthusiasm.
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There are three grades associated with the game

» Game day performance (20 percent)
  • Top team gets 100
  • Bottom team gets a score between 50-70, depending on how well it does.
  • Everyone else is scaled in between.

» Project report (15 percent)
  • A modeling exercise (you prepare a mathematical model of a portion of the game).
  • Summary of your activities on the team.

» Evaluations (15 percent)
  • Each member writes an evaluation of every other team member using careful guidelines.