Wall Street as a Quantitative Workplace

02/10/05
FE Club Talk
Alex Kuznetsov
Barclays Capital
What will happen today

- The goal:
  - explain what people with quantitative skills actually do on Wall Street
  - describe different types of employers
  - describe different job roles available

- Outline/scope:
  - what Wall Street consists of – industry structure
  - internal organization and technology:
    - of a broker-dealer
    - of other players
  - technology areas you will interact with
  - business side/technology side
  - things to look at in a job offer
What is Wall Street

■ Our working definition:
  ■ firms where an FE graduate can find interesting work
  ■ generally, financial services companies involved with trading of securities and other assets

■ What is NOT Wall Street:
  ■ real estate
  ■ most securities issuers:
    ■ corporations, governments/agencies, municipalities
    ■ retail banking

■ In the US:
  ■ total employment in financial industry: ~5 million
  ■ total employment on Wall Street: ~250 thousand
  ■ of which technology: ~70 thousand
The two sides of Wall Street

- **Buy-side:**
  - asset managers/investors (real money)
  - speculators (fast money)

- **Sell-side:**
  - Large “investment banks”
    - active in both primary and secondary markets
    - act as brokers and/or dealers for buy-side firms

- **Middle:**
  - intermediaries:
    - interdealer brokers
    - exchanges
    - service providers
Picture the flows

Issuers

US Treasury
Fannie Mae
General Motors

Sell-side

Goldman
Garban
Merrill
Lehman

Buy-side

Blackrock
PIMCO
CALPERS
DE Shaw
Bank of England
Boeing
Inside a broker-dealer

- between 5,000 and 25,000 people overall
- split into divisions
- where would you end up, most likely?
  - trading, risk management, or technology

```
Top management
  /   \
Legal/Compliance Revenue-producing Technology Risk Management
   /    \\       \\       \\     \\       \\
Investment Banking Equities Fixed Income Retail/prime brokerage Asset management
```
Inside a trading division

- between 500 and 5000 people overall
- split into business lines and further subdivided into individual trading desks by product areas
- each desk is 5-25 traders plus assistants etc
- there is also sales organization that works across product areas

![Diagram of Fixed Income Division with subcategories such as FX, Rates, Credit, Mortgages, Munis, Treasuries, Swaps, IR Derivatives, and Structured Products connected to a Sales force at the bottom.]
What people do in sales/trading

- A salesperson’s day:
  - call each of your accounts
  - solicit trades:
    - if a customer wants to trade, pass the request to the appropriate trading desk
    - get sales credits if you bring in a trade
  - performance: total sales credits

- A trader’s day:
  - respond to customer inquiries
    - quote prices
    - execute trades
  - performance: total PnL (profit and loss)
  - manage risk and PnL of your books
  - provide closing prices for your securities
Front, middle, and back

- Front office: writes trade tickets
  - all customer-facing activities:
    - sales/trading
    - research
- Back office: turns them into money
  - trade processing
    - trade records
    - reconciliation
    - settlement
    - official risk and PnL reports
- Middle office:
  - the plumbing between front and back
Where do we belong in this picture?

- Trading and risk management activities are quantitatively and technologically intensive.
- Review technology needs of:
  - trading
  - risk management
  - sales
  - back office
- Discuss how these needs are met:
  - technology organization
  - business/technology interface
What traders need

Pricing:
for everything they trade:
  what is it worth:
    right now (given current market data)
    at closing time (given closing prices)

Valuation models
  generic
  desk-specific

Market data

Display and analysis tools
What else traders need

- Risk and PnL
  - PnL (profit and loss):
    - current
    - end-of-day
  - risk exposures to things that can change:
    - active prices (futures, on-the-runs, swap rates)
    - volatilities
  - What it takes:
    - Valuation models
    - Risk models (taking deltas of valuation models)
    - Display and analysis tools
    - Trade management/position management
- Relative value/proprietary trading models
What salespeople need

- Trade ideas to convince customers to trade with us:
  - often require quantitative arguments and analysis
- Research reports to keep customers happy:
  - relative value reports
  - closing prices
  - market commentary
- Historical data access and analysis tools
- Access to firm’s technology for their clients:
  - web-based analytics
  - historical data tools
What risk managers need

- Access to positions across the firm
  - trade databases
  - position management
- Valuation tools
- Risk models:
  - different from desk-level models
  - VaR
  - Scenario analysis tools
  - Credit risk models
- Software that runs the models and generates reports
- Back office has similar needs:
  - today’s snapshot of positions/cash flows
  - settlement and clearing systems
History of Wall Street technology

- How these technology needs are met
  - Talk about large dealer firms first
    - others are usually subsets of that
  - The three levels:
    - individual business/desk level
    - divisional level:
      - integrates needs common to businesses in the division
      - aligned with but does not belong to the businesses
    - firm-wide level:
      - back office
      - risk management
      - infrastructure

- Need some historical perspective
Wall Street technology: 1975

- desk level:
  - nothing

- division level:
  - nothing

- firm-wide level:
  - mainframes for back office tasks
Wall Street technology: 1985

- **desk level:**
  - desk quants/programmers

- **division level:**
  - nothing

- **firm-wide level:**
  - mainframes for back office tasks
  - workstation networks
  - database technology

- Desk quants
- Programmers

- back office systems
  - networks
  - databases
Wall Street technology: 1990

- **desk level:**
  - quants remain
  - programmers move to divisional level

- **division level:**
  - technology groups serving specific businesses
  - research departments

- **firm-wide level:**
  - modern payments systems
  - databases
  - networks
  - market data
  - birth of RISK MANAGEMENT

**Diagram:**
- Desk quants
  - Programmers
  - quasi-academic research
  - IT
    - software development
  - databases
  - networks
  - market data
  - Risk mgmt
Wall Street technology: 1997

- **desk level:**
  - quants remain
  - but administratively begin to report to divisional level

- **division level:**
  - (technology groups serving specific businesses)++
  - “core” technology
  - (research departments)--

- **firm-wide level:**
  - electronic trading
  - enterprise management

---

front-office software development
core analytics

**IT**
- databases
- networks
- market data
- e-trading
- infrastructure

Desk quants  
quasi-academic research  
Risk mgmt
Wall Street technology: 2005

- desk level:
  - pure quants increasingly rare
  - almost all desk needs are met by division-level IT/research

- division level:
  - research departments mostly absorbed by IT
  - quant/programmer line blurred again

- firm-wide level:
  - many divisional tasks migrate to firm-wide IT
  - such as core analytics
Beyond dealer banks: 2005

Buy-side/Asset managers:
- Blackrock, PIMCO, Fidelity
- have fairly large technology organizations
- focus on risk management
- trading but no sales – portfolio managers instead

relative to dealers:
- ADD:
  - portfolio analysis, relative value models
- REMOVE:
  - sales technology, market-making technology, structured products etc
Beyond dealer banks: 2005

- **Hedge funds:**
  - over 5000 in the US/9000 worldwide
  - 2 – 200 people in each
  - usually farm out back office technology functions
  - focus on prop trading/relative value modeling
  - probably the only place where pure quants or quant/traders still flourish
Beyond dealer banks: 2005

- Brokers/exchanges:
  - Garban/ICAP, Tullett, CBOT, CME…
  - much smaller technology
  - focused on pricing and e-trading infrastructure
  - often have sophisticated pricing/analytics needs
  - no risk and no risk/position management
Beyond dealer banks: 2005

- Financial software industry:
  - Software companies proper:
    - Analytics:
      - TechHackers, NumeriX, …
    - Back office/Risk management:
      - Summit, Sunguard, BARRA
  - Service providers:
    - Bloomberg, Reuters, Thomson, …
  - Focus on “generalizable” things:
    - financial analytics
    - risk management models
    - trade capture and settlement
  - Compete with tech organizations of big banks
Working in a technology group

- A typical set-up:
  - a business unit (trading desk)
  - has several technical groups doing different projects for them
  - each would be 5-15 people – a mix of quants and developers, senior/junior

- What you will do all day:
  - develop your piece of the overall puzzle
  - resolve issues with your group’s systems
  - interact with others

- Who you will interact with:
  - your colleagues within the group
  - the business
  - standard infrastructure groups
Technology environment

- Questions you will face on a daily basis
- Present everywhere and done differently everywhere:
  - Instrument data:
    - static: what’s the coupon on that bond?
    - historical: what’s the closing price for IBM on ???
  - Trade data:
    - how do I see a list of trades done in that book?
    - how do I stuff my new derivative into the firm’s booking system?
  - Analytics:
    - which library has this model?
    - how do I get it changed so it does this?
  - Market data:
    - how can I see what’s the market doing right now?
- Software development and support:
  - where do we put our code?
  - how do we build, test, and deploy our systems?
  - what do we do when they break?
## Business side and technology side

- **Which side are you on?**
  - paid by a business unit:
    - business side
  - paid by a technology unit:
    - technology side

- **Business side:**
  - you tell technology what to do
  - your life is buy low, sell high

- **Technology side:**
  - interesting, challenging work
  - often more bureaucratic

- **Power structure:**
  - business used to dominate unquestionably
  - now it’s not so simple

### Roles

<table>
<thead>
<tr>
<th>Trading/Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quant/Traders</td>
</tr>
<tr>
<td>Analysts hired by the desks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Front Office Technology Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional desk quants</td>
</tr>
<tr>
<td>Sales research</td>
</tr>
</tbody>
</table>

| Firmwide IT |
Interacting with the business side

Do ALL YOU CAN to understand:
- market conventions, drivers, terminology/slang
- how your business unit makes money
- what is its role in the company

Your usefulness is measured by your ability:
- to understand business needs
- to offer workable solutions
- to get them done within existing tech structure
In conclusion

- When trying to find your place in this industry:
  - draw your net wider:
    - are big banks still the best workplaces?
      - probably still the best in terms of learning opportunities
    - look at financial software industry
    - look at smaller players on the buy-side

- When evaluating job offers, make sure you understand:
  - your place on the market organization diagram
    - what is the business model of your employer?
  - your place on the internal organization diagram
    - desk-level, divisional or firmwide

- Main goal:
  - try to get close to business/technology interface