Investing in EU Biotech IP - What Works?
IP supports an ecosystem where investors are willing to lose everything 92% of the time, in order to fund the 8% of medicines that succeed.
Last Year at Gastein, We Presented This Study

Radu Munteanu, UCSD, 2010  The biotechnology cluster in San Diego

- NIH $449 mil, primarily rewarded to the Scripps Research Institute and UCSD
- IPO $1 bil, VC $2.4 bil = $3.4 bil
San Diego Study Findings

• Statistically, the most important predictor of success in a biotech firm in San Diego was the size of the IPO (money gained by listing on the stock market)

• NIH (Government) funding to the university supporting a spin out was a negative indicator, but not statistically significant

• We were asked by many in attendance to replicate this research for EU biotech
The Study Methodology

• Analyse all EU Biotech Start-ups from the period of 2001 – 2007 through September 21, 2018 in the UK, Netherlands, Belgium, and Spain

• Only companies developing medicinal products for human consumption to be included, not diagnostics, devices, cosmetics, or agricultural bio.

• Compare the impact of IPOs, Private Investors, and direct EU funding on the success or failure of the company
Defining a Successful Company

Success Criteria

• Going concern, continued operation moving through clinical research
• Funding rounds/partnerships related to a successful Phase 1 or Phase 2 result of research
• Success in hitting research targets, often in EU collaborations or private licensing agreements
• Company or assets acquired with value increase (sold at a premium)

Not a success

• Ceases to trade
• Zombie company with no activity nor clinical trials over multiple years
• Major failure of lead product trial (often with unpublished trial results for academic spin outs and early stage companies)
• Acquisition at a loss, salvage sale of a company
The Study Sources

- Medtrack/Informa
- Annual reports
  - Companies House (UK)
  - Dutch Chamber of Commerce
  - InfoEmpresa (ES)
  - TrendsTop (BE)
- Press releases/Internet search
- EU CORDIS (Community Research & Development Information Service) and EU FTS (Financial Transparency System) databases – A record of all funding received by organisations from the EU under Framework Research Programmes from 2001 to the present
Total Number of Firms Studied by Country

- Belgium: 9 companies
- Netherlands: 20 companies
- Spain: 22 companies
- UK: 65 companies
- Total Companies: 116

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Total Amount of Investment by Type

Total Invested USD (000,000)

- Private (VC, Angel, Licensing) $29,951
- IPO $1,242
- EU CORDIS $61
Firms Succeeding and Failing

- UK: 32 Failing, 33 Success
- Spain: 14 Failing, 8 Success
- Netherlands: 5 Failing, 15 Success
- Belgium: 2 Failing, 7 Success
Total Amount of Investment
Average per Firm

Average Total Private Funding Per Firm
$USD (000,000)

- UK: 281.3
- Spain: 20.6
- Netherlands: 46.5
- Belgium: 1102.5

Average EU Funding Per Firm
$USD (000,000)

- UK: 0.2
- Spain: 0.7
- Netherlands: 1.1
- Belgium: 1.5
Successful and Not Successful Firms
Private Funding Per Firm Far Exceeds That in EU CORDIS

**Average Amount Privately Funded**

<table>
<thead>
<tr>
<th></th>
<th>Successful</th>
<th>Failing</th>
</tr>
</thead>
<tbody>
<tr>
<td>$US (000,000)</td>
<td>405</td>
<td>84</td>
</tr>
</tbody>
</table>

**Average Amounts Funded in EU**

<table>
<thead>
<tr>
<th></th>
<th>Successful</th>
<th>Failing</th>
</tr>
</thead>
<tbody>
<tr>
<td>$US (000,000)</td>
<td>0.69</td>
<td>0.33</td>
</tr>
</tbody>
</table>
A Minority of Successful Firms Attract Large Investments
This creates a high amount of variance

The median value means half of our ‘successful’ firms have raised $34.5 mil or less
Failing Firms Often Have Large Investments Before the Product Fails
This creates a high amount of variance

The median value means half of our ‘failing’ firms have raised $3.3 mil or less

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>1st</th>
<th>Median</th>
<th>3rd</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Private &amp; IPO $USD Mil</td>
<td>0.00</td>
<td>0.000</td>
<td><strong>3.300</strong></td>
<td>12.433</td>
<td>1255.20</td>
</tr>
</tbody>
</table>
Public or Private Investment in IP
What Drives Success?

Do EU Grants in CORDIS, Private Funders, or IPOs (listing on a stock market) have a statistically significant impact on the success of a firm?

Logistic Regression will allow us to test these hypothesis against a binary answer “Success” or “Fail”
Do IPO’s Impact the Success of EU Firms Statistically? No

Logistic Regression - Probability of Success

Source | -LogLikelihood | DF | G² statistic | p
--- | --- | --- | --- | ---
Difference | 0.097132 | 1 | 0.19 | 0.6594
Fitted model | 79.876 | 114
Null model | 79.974 | 115

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Total Private Funding is Statistically Significant

Logistic Regression - Probability of Success

Total Private & IPO Per Firm $USD (000,000)

<table>
<thead>
<tr>
<th>Source</th>
<th>LogLikelihood</th>
<th>DF</th>
<th>G² statistic</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference</td>
<td>3.2443</td>
<td>1</td>
<td>6.49</td>
<td>0.0109</td>
</tr>
<tr>
<td>Fitted model</td>
<td>76.729</td>
<td>114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Null model</td>
<td>79.974</td>
<td>115</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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EU Funding is NOT Statistically Significant
Logistic Regression - Probability of Success

Total EU Grants Per Firm $USD (000,000)

<table>
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<tr>
<th>Source</th>
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<th>DF</th>
<th>G² statistic</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference</td>
<td>1.0378</td>
<td>1</td>
<td>2.08</td>
<td>0.1497</td>
</tr>
<tr>
<td>Fitted model</td>
<td>78.936</td>
<td>114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Null model</td>
<td>79.974</td>
<td>115</td>
<td></td>
<td></td>
</tr>
</tbody>
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Is EU Funding Correlated to Private Funding?
Testing Private Funding’s Prediction of EU Funding

A Mess, No Statistical Certainty...

Source | SS         | DF | MS          | F          | p-value
-------|------------|----|-------------|------------|--------
Difference | 0.193622733 | 1  | 0.193622733 | 0.08      | 0.7739
Error      | 94.972322463 | 41 | 2.316398109 |           |        
Null model | 95.165945197 | 42 | 2.265855838 |           |        

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Total Amount of Investment
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- UK: 281.3
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Could this be impacting our regression
Testing Private Funding’s Ability to Predict the Amount of EU Funding in BE, NL, ES (UK Removed)

Private funding predicts EU funding to biotech companies - high statistical certainty

<table>
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<tr>
<th>Source</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference</td>
<td>11.37994501</td>
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<td>11.37994501</td>
<td>13.60</td>
<td>0.0010</td>
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<tr>
<td>Error</td>
<td>22.592707523</td>
<td>27</td>
<td>0.836766945</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Null model</td>
<td>33.97252024</td>
<td>28</td>
<td>1.213309001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Does EU Funding Predict Success in European Biotech if the UK is Excluded from the data?

**Graph: **

- Y-axis: Success Y/N
- X-axis: Total EU Grants $USD (000,000)

**Table:**

<table>
<thead>
<tr>
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<th>-LogLikelihood</th>
<th>DF</th>
<th>G² statistic</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference</td>
<td>0.69921</td>
<td>1</td>
<td>1.40</td>
<td>0.2370</td>
</tr>
<tr>
<td>Fitted model</td>
<td>33.853</td>
<td>49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Null model</td>
<td>34.552</td>
<td>50</td>
<td></td>
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</tbody>
</table>

**Result:**

Nope
The International Marketplace for Biotech IPR

US Bought 70% of Mature IP in 2017

BIOTECH M&A BY BUYING COUNTRY
2015 - 2017
$US Millions

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https://www.thepharmaletter.com/article/an-all-time-record-year-for-pharma-biotech-m-a
https://www.thepharmaletter.com/article/pharmaceutical-m-a-deals-in-2017
Research Results

• The total private funding given to a firm (IPO, Private Investment, Licensing) is statistically significant to the firm’s probability of success

• Initial Public Offerings (Stock Market Listings) do NOT impact the success of EU firms, this may be a reason that mature firms are leaving the EU

• EU funding given directly to a firm does not impact the success rate of the individual firm with statistical certainty

• EU funding given directly to a firm can be predicted with certainty by the total amount of private investments made to a company in BE, NL, and ES, but not the UK. i.e. Private investments predict levels of EU funding

• “The Market” decides which firms will be successful by allocating resources; actions that impact investor confidence (threats against IPR, attacking market exclusivity) will negatively impact the amount of private money invested and the success of firms