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FieldsRank: The Network Value of the Firm

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What's wrong with finance

"…individuals face enormous practical difficulties in doing what economists assume they do all the time – maximize their utility. The future simply has too many variables to be knowable. Take, for example, the standard definition of the value of a single share; it is equal to the future cashflows from said share discounted at the appropriate rate. But what will those cashflows be? Analysts struggle to forecast the outlook for companies over the next 12 months, let alone over decades. And the right discount rate depends on the level of investors' risk aversion, which can vary a lot from month to month. Robert Shiller won his Nobel prize, in part, for showing that the market price of shares was far more volatile than it would have been had investors had perfect foresight of the future dividends they would have received."

Philip Coggan (The Economist, Financial Times)

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Motivation for the Research

› Any new theory of valuation should comply with the core principle of corporate finance: value creation is a function of returns on capital and rates of growth (Dobbs, Huyett, and Koller, 2010). But there is something special in the nature of the digital firm: whereas a traditional shop relies in a venue and the flow of visitors attracted by material means (from personal recommendations to billboards), the informationbased business might be totally transparent in terms of infrastructure; in fact, a clever algorithmic startup may run entirely on automated platforms, attract its customers through recommendation engines, provide an intangible service or product and get paid by cryptological means (e.g Bitcoin). That is, when going from idea to economic activity only intangible valuable can be measured and, traffic flows anticipate cash flows. If we are to appraise informationbased businesses, it makes sense to use an informationbased metric. And, with cognitive systems, industrial grade internetofthings, blockchain ledgers, and sharing economy business models finally becoming mainstream, this is also a pressing issue.

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Fields Finance Approach

›The premise then is that traffic patterns encode perceived value as expressed by user preferences. Such an approach can have strategic management applications, beyond the prospecting case for valuation: if the goal and mechanics of value creation are understood first, utility naturally follows. The backward anticipation possibilities that the capability to visualise the playing field enables works in two steps: find the desired type of grow, and, engineer your firm that way.

›Fields Finance draws upon the powerful flow descriptor capabilities of Vector Fields, which are specially suitable to visualise relationships across the multilayer domains of a digital ecosystem (including the web, social networks, email, advertising networks, apps and the internetofthings), and fit for applying statistical rigour to behavioural dimensions as revealed by brand signals. The authors present a systematic approach to map, estimate and predict relative value of the digital firm using the *FieldsRank* model and a workflow based on cognitive computing (i.e. augmented/artificial intelligence); the process is validated using real data.

Economic Background

› To this day, the value of the firm as an economic measure has been assessed mainly in function of direct revenues, or as a sum of claims from creditors and equity holders. However, in the context of the digital economy this approach is unworkable for both regulators and investors, since organisations proliferate and reach large scales long before there is any meaningful data available to quantify revenues, or assess the quality of their business model. Moreover, due to the network nature of digitally native companies (or the digital branches of brick and mortar firms) it is clear that they do not exist in isolation, but are actually influenced and exercising influence in other firms and networks. The connecting stream across entities is traffic: traffic inflows encode the value they receive from the network, and traffic outflows the value they contribute to the network; in essence, traffic makes the map of dependencies emerge.

› Thus the crucial question is:

  › **can traffic flow indicate relative value of the firm,**
   and
  › **the value created by the strategic decisions of its management?**

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Research Outcomes

› We have introduced the idea of a "Fields Theory of Finance" that builds upon vector fields, information theory and complex networks theory, and it is compatible with both mainstream finance and artificial intelligence tools.

› The *FieldsRank* approach can be applied to the brand or the business as a whole, even in conditions of uncertainty and no access to private information. We validated the model using real data from the microinvesting industry, a branch of Fintech (financial technology, financial ventures) where bankers have developed an interest in recent months -not less because of competitive pressures, but because they have started to partner with, and develop those businesses themselves.

› We have proved that when utility is measured as the information content of traffic flows, difference in utility signals value, i.e the different ways venture capital investors "frame decisions and code outcomes, and their attitude toward risk" (Belsky and Gilovich, 1999), follow the multiple paths of behavior of clients choosing a microinvesting service in our portfolio of 12 predominantly digital companies.

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FieldsRank's analytical formulation

$$\text{Network Value}_{outgoing} = FR_{OUT} = E_{intrinsic} + E_{outflows} \quad (15)$$

$$\text{Network Value}_{incoming} = FR_{IN} = E_{intrinsic} + E_{inflows} \quad (16)$$

$$\text{FieldsRank}_{TOTAL} = \beta\, E_{in} + E_i + \alpha\, E_{out} = \text{Network Value}_{total} \quad (17)$$

$$\text{Network Value}_{added}: \Delta E_{t1-t0}, \text{or}, \Delta E_{FirmB-FirmA} \quad (18)$$

$$\text{Value stream}_{incoming} = \sum_{s \in IN(Firm)} (TT \times \theta \times CR)\, CLV \quad (19)$$

$$E(x) = -\sum_i p_i \log p_i \quad (20)$$

$$CLV = \sum_{t=0}^{T} \frac{(f_t - c_t)r_t}{(1+i)^t} - AC \quad (21)$$

Where,

$E_i = E_{intrinsic}$: Entropy of direct traffic forms (e.g email, direct visitors to a website, connected devices)

$E_{in} = E_{inflows}$: Entropy of referral traffic (e.g from partners, media, search engines, social networks, and other intermediaries)

$E_{out} = E_{outflows}$: Entropy of outlink traffic (e.g to social networks, competitors, own sites), computed at least for 2 consecutive transmission levels

α: adjustment factor for spreading force

β: adjustment factor for sink risk

t_0, t_1: time interval, when comparing the same company across different time periods
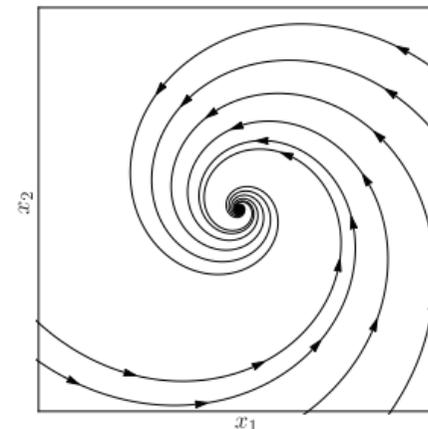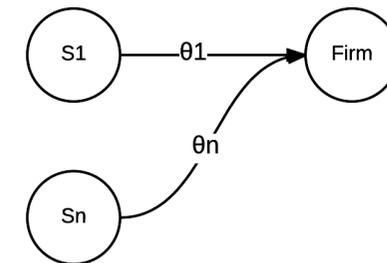
FirmA, FirmB: companies being compared

s : source

θ : traffic share (from traffic source)

TT: total traffic (incoming visits)

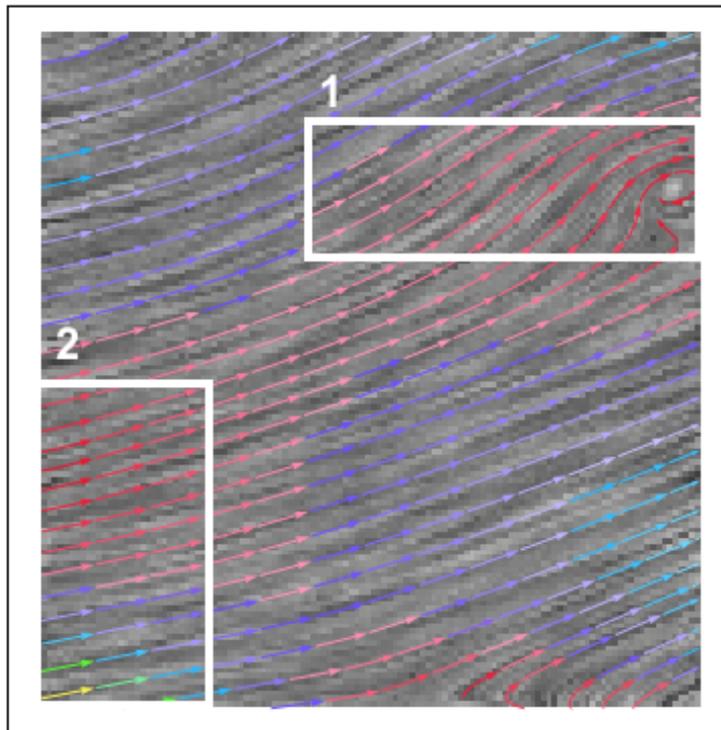CR: conversion rate (percentage of visits that result in a purchase/client engagement)

CLV: customer (client) lifetime value

› Cashflows are studied in relation to network flows dynamics and the entropy-utility duality (information theory)
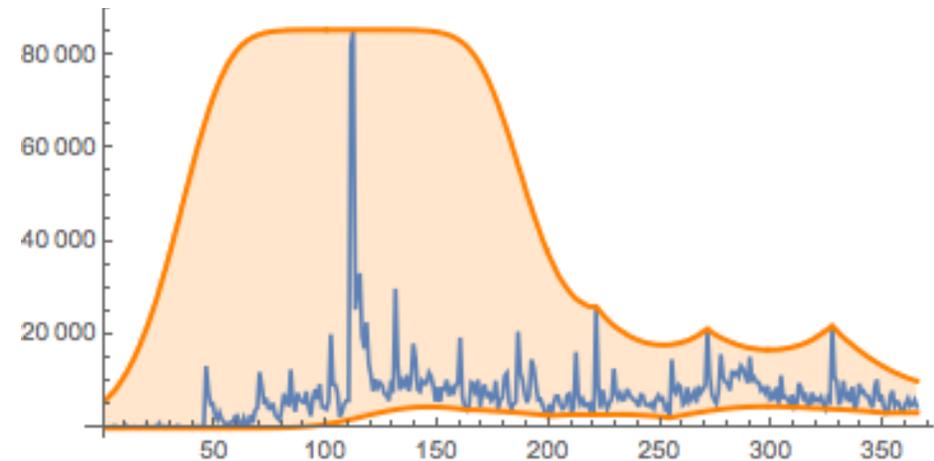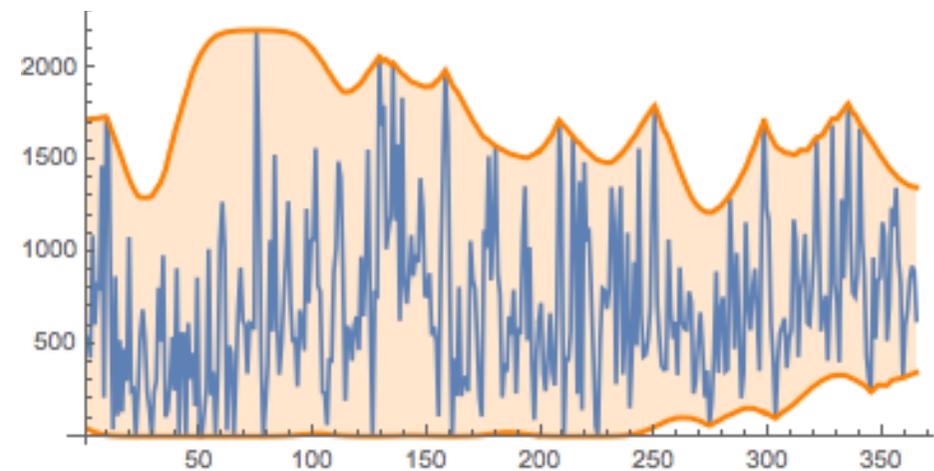
Visualisation of portfolio inflows

Traffic intensity and direction as measured by visits to website of 12 portfolio companies

Detail of the stable topology (center in FirmK)

FirmG Volatility characteristics during the first year of operations

FirmK: lower variability, but growth wise, stuck in the middle

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Cognitive computing (AI) workflow

› **Over/under estimation of value.** The upside (green dotted line) of CompanyG -or any company of similar traffic characteristics at its level of funding- and the regularities (and lack of critical points) in the field view, point to CompanyG having incoming traffic characteristics similar to more established players. All this suggests that CompanyG is punching below its weight. It is also possible to experience diminishing returns: once a certain level of intrinsic flows is attained, more incoming traffic is not positively correlated to higher funding.
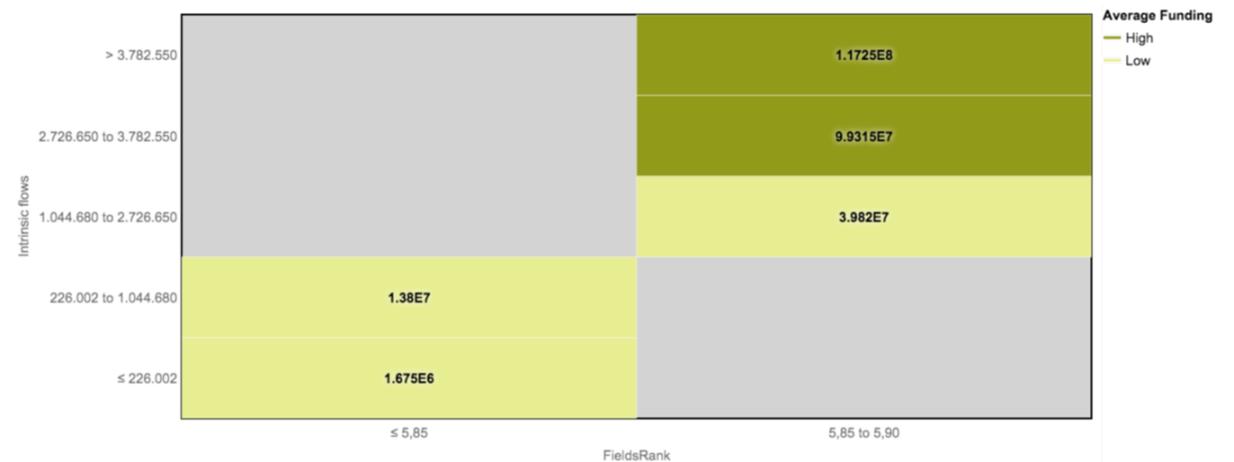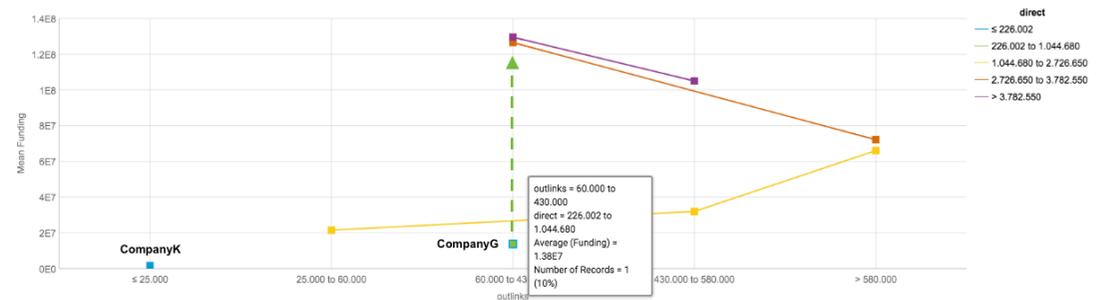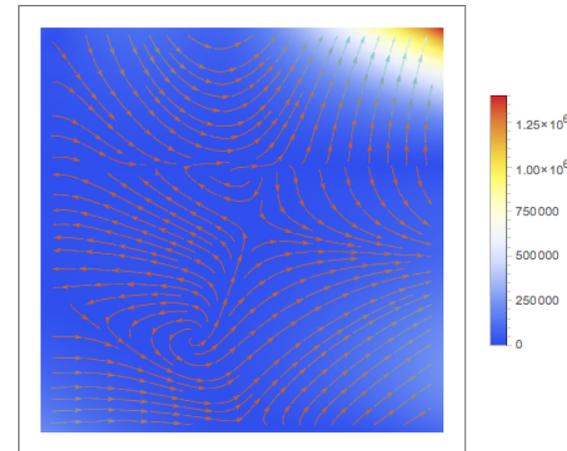

Predictive model (ANOVA, IBM Watson Analytics)

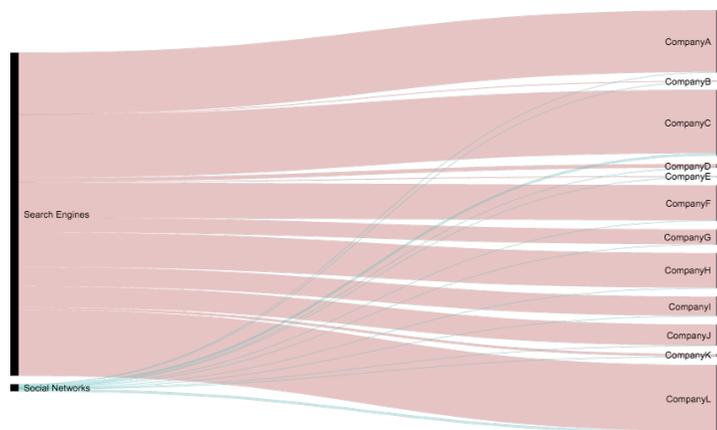ŠKODA

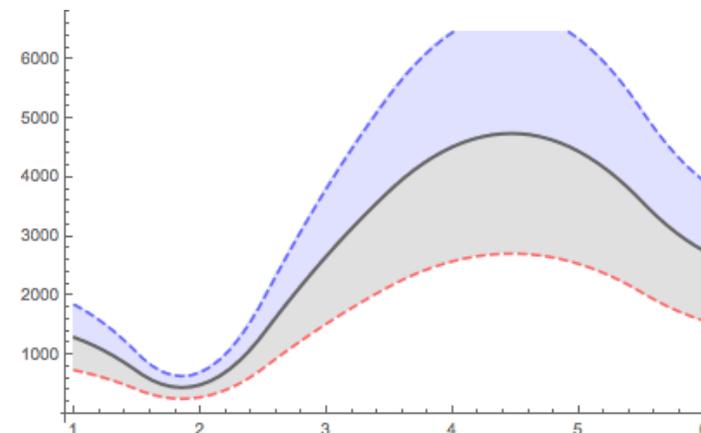# Impact of Customer Acquisition Costs
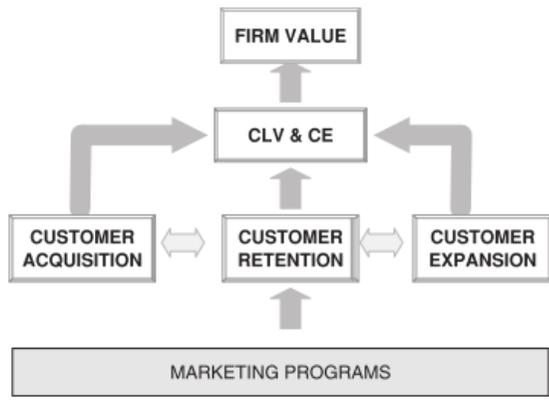
Classical formulation of CLV

Acquisition Cost flows. FirmL (top right corner) leads in funding and spends aggressively in client acquisition

Magnitude of branded traffic, FirmL leads the pack

Sensitivity analysis, value stream derived from CLV for FirmL (three conversion rate scenarios at fixed margins)

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Fields Finance Decision System

› We found significant weak interaction effects of the entropic measurement on company funding: FieldsRank and inflows, FieldsRank and outflows, and FieldsRank and intrinsic flows. We refer to this as the Value Content of Information Flows. The quantitative and graphical methods showed that the field summaries risk dependencies, momentum, diversification, liquidity and visibility characteristics.

› Value Streams provide an elegant way to connect traditional finance to the needs of modern day finance: Client Lifetime Value as an estimate of customer profitability transforms demand estimation data (e.g traffic flows) into a cost allocation and traceability aid. Demonstrating the Network Value of the Firm approach with FieldsRank speaks for the applicability of a "Fields Theory of Finance" when information is incomplete, such as in alternative finance; but as with any framework compatible with the Discounted Cash Flow approach, a broad set of applications exists, from financial markets to marketing and strategy.

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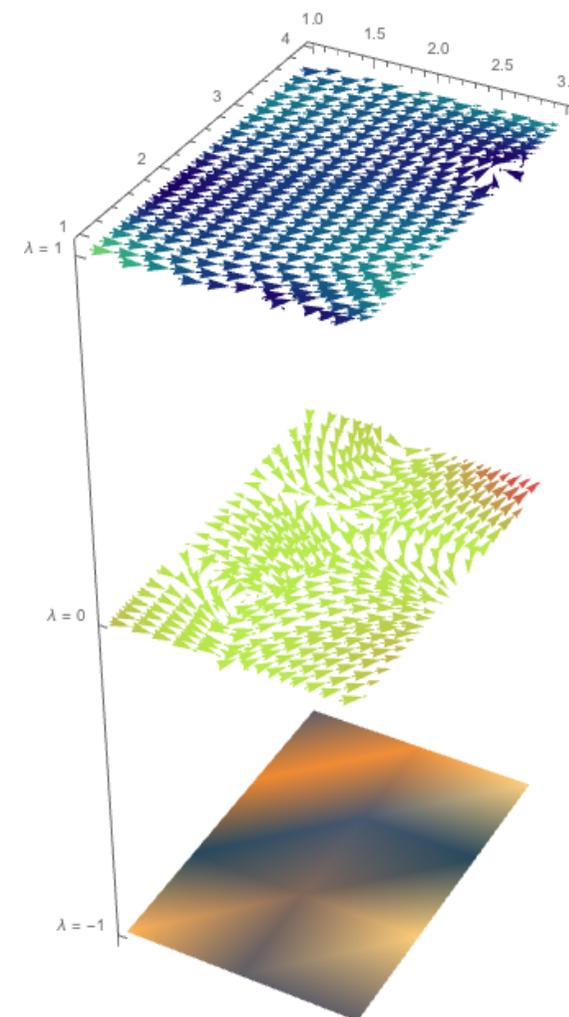
Summary of the portfolio with incoming flows ($\lambda=1$), costs flows ($\lambda=0$) and funding ($\lambda=-1$).

Questions and answers