

# a₹tha

A NEWSLETTER OF THE FINANCE LAB

March 2018, Volume 4, Issue 4



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Indian Institute of Management Calcutta

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# Editorial

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This issue of Artha is the first one after Budget 2018. Since lots have already been written on the budget, we have decided not to overload you with more opinion on budget. Indian financial sector is passing through a challenging time. Massive bank frauds and large volume of non performing assets in the balance sheet of most of the banks are the talking point in any deliberations on Indian banking industry today. The Securities and Exchange Board of India (SEBI) has this month tightened the regulations of financial markets. In order to curb 'advantage' of algo traders who are operating from co-location facilities, SEBI has decided that co-location services will be shared and algo traders will now have to pay congestion charges for choking the limit order book. In order to ensure that derivatives and cash markets move in tandem, SEBI has stipulated that derivatives on stocks, that do not meet certain eligibility criteria, would have to be settled through physical delivery. This stipulation may bring down number of stocks that are presently traded in derivatives segment of the markets. The impact of these recent changes will surely be felt in near future.

The first article is a multi-part essay that discusses various valuation technique applicable for start-ups. This will cover various methods of valuation of start-ups from idea stage to public listing. This article looks at valuation of ideas. The second article discuss the decision taken by Supreme Court of India of banning of BS-III compliant vehicles. This will lead India achieving emission standard as par developed countries. However, the path is not so smooth. The third piece deals with the loose monetary policy of Central Banks which is a sign of return of inflation and growth in an inter connected global economy and the near identical mindset of the central bankers. In the fourth article, the author highlights that in a market where traders are self-taught, deep-learning networks, if something goes wrong, how do we know who to blame?.

The *Market Watch* section in this issue deals with the banking frauds that have come to light recently.

You may send your comments and feedback on this issue to [ashok@iimcal.ac.in](mailto:ashok@iimcal.ac.in)

Happy reading!

**Ashok Banerjee**

# Valuing Start-ups- Part I

**Ashok Banerjee**



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The start-ups in India, as in other parts of the world, are having a dream run over the past four years. The startup India campaign of the Government was able to create a friendly ecosystem that has emboldened young minds to innovate, take risk, raise funds, and flourish. Private equity and venture capital funds are chasing startups that have massively grown in scale, irrespective of whether the idea is really disruptive. During the first quarter of 2018, startups and growth-stage ventures in India, excluding Flipkart and Paytm, have raised more than \$2 billion from private equity market (Table 1). Notable among them are Bigbasket (\$300 million), Zomato (\$200 million), Gaana (\$115 million), and Swiggy (\$100 million). Tech-based retail raised almost \$700 million in past three months, closely followed by Finance (including FinTech).

How many of these companies (Table 1) really have innovative ideas? Well, innovation does not necessarily mean absolutely new and untried inventions. Innovation includes process innovation and in that respect most of the successful startups in India have demonstrated ability to scale up quickly. Gaana, a music streaming platform, has about 60 million subscribers and witnessed a 700% increase in its Internet services accessed by customers in the past one year. Established in August 2014, Swiggy, an online platform that delivers food from restaurants, delivers more than 100,000 orders per day. It has raised more than \$255 million in past three years. Lendingkart, an online platform that provides working capital loan to SMEs, which was also incorporated in 2014 had reported a registered user base of 450,000. It has raised more than \$173 million so far. Thus, funds chase those start-ups that chase growth.

**Table 1: Funds raised in private equity market (January-March 2018): Select List**

Month	Company/Startup	Amount (\$M)	Sector	Lead Fund
January	Indiabulls Housing Finance	154.0	Housing Finance	Yes Bank
	Mediplus	117.6	Healthcare	Goldman Sachs
	Rivigo	50.0	Logistics	SAIF Partners
	Neogrowth	46.4	FinTech	Leapfrog Investments

February	Bigbasket	300.0	Retail	Alibaba
	Zomato	200.0	Retail	Alibaba
	Swiggy	100.0	Retail	Naspers and Meituan Dianping
	Lendingkart	87.0	FinTech	Fullerton Financials
	Browserstack	50.0	IT	Accel
March*	Gaana	115.0	Entertainment	Tencent
	Grofers	61.3	Retail	SoftBank
	Chargebee	18.0	FinTech	Insight Venture Partners
	TOTAL	1299.30		

\* Up to 26 March 2018

Source: Tracxn and Internet

Start-up valuation is quite challenging and it is more an art than a science. Traditional valuation methods may not apply in most cases. The life cycle of funding of a start-up includes bootstrapping, grants, angel investments, venture capital (VC) funds and private equity (PE). Thereafter, any start-up will have to raise public equity. Of course, venture debt is now available to start-ups, which have already accessed venture fund. Banks would normally avoid financing a startup due to uncertainty and lack of collaterals. Valuation of any start-up, therefore, would depend on the stage of financing life cycle. Valuation method at grant stage would be quite crude and even at angel stage financing happens mainly on the strength of the team and the idea. Sophisticated valuation methods are used when institutional funding (e.g. VC and PE) is accessed by any start-up. Valuation methods used by a PE are similar to the ones used for IPOs (Initial Public Offer).

Therefore, I will try to cover various methods of valuation of start-ups from idea stage to public listing. The multi-part essay will discuss various valuation techniques applicable for start-ups. This article looks at valuation of ideas.

## Valuing Idea

How do you value an idea that does not even have a prototype or proof of concept? It is impossible to value an idea that does not have a minimum viable product (MVP) and hence no one would like to fund such an idea. Ideas may come easily if one has keen observation power. However, idea does not fetch money. One needs a committed operator to give shape to an idea that is eventually accepted by the market. Such an operator is called an entrepreneur. An entrepreneur has to get the prototype made with own (including family) money and secure customer validation. Making prototype (proof of concept) is no more costly in India with availability of affordable infrastructure. For example, entrepreneurship development centres in colleges/universities, fabrication labs in technical universities, and incubators supported by the Department of Science and Technology (DST) and Atal Innovation Mission (AIM), Government of India. These institutions or facilities are willing to provide small financial support sufficient to make a few prototypes for testing purposes.

The most important questions in any valuation exercise are (a) who are your customers? (b) how much is the market opportunity? and (c) how much market share one can capture? If a start-up does not have MVP, answering these questions would be almost impossible. Answering the first question (know your customer) is not always easy. On many occasions the beneficiaries may not be the ones who would pay. Famous examples would include Google and Facebook. Google and Facebook control almost 70% of the digital advertisement market. However the majority of the registered users/subscribers of these two Internet giants do not pay for the services. So, Google's revenue will be driven more by the growth in digital advertisement spending and less by the linear growth in search engine hits.

Idea needs to be priced. Lot of it would depend on the quality of the innovator and her team. The problem with any innovator is in many situations, the inventor may have no clue about the MVP and hence price. In order to get close to the stage of pricing, ideas must be given shape in terms of proof of concept or prototypes.

Even for an established company, which has been into business for many years, pricing a new product or solution is difficult. Take the case of a tractor company that has in its stable an army of tractors of different capacities with maximum engine strength of 32HP (horse power). The tractor company now wishes to launch a new generation of tractors (Generation Y tractors) of 64HP. What should be the price of this proposed high-powered tractor? How much will be the business volume? Will it cannibalize business of its existing tractors? The company had never had such a tractor nor did any other company in India. So there is no compatible data available. The only way the tractor company may try to estimate the launch price of the tractor and the business volume is through a detailed market research. Such research will involve talking to prospective customers (i.e., farmers), identifying whether such a high-powered tractor is at all necessary and knowing what problem of existing users is the proposed tractor going to solve. The research will also help identify the unique selling propositions (USPs) of the new vehicle and perform a proper quality function deployment (QFD) to design the specifications of the tractor. Such an exercise will also help in arriving at the bill of materials (BOM) cost of production. Next question will be what is the USP of this tractor and whether the prospective customers would be willing to pay the price for each USP. For example, if the noise-level of the proposed tractor would be lower than the existing ones, would a customer be willing to pay any extra price for such a feature? If yes, how much more? Answer to these questions would perhaps give some idea of the extra price that a prospective customer will be willing to pay for the new product. It is a well-known fact that in a competitive market, price of a product is not determined by its cost of production. It rather depends on how much a customer is willing to pay (target price). Estimation of business volume for the new tractor would depend on how many of the respondents would like to migrate to the higher version of the tractor. The entire exercise may take anywhere between 6 and 12 months to obtain three basic input for valuation, i.e., the target price, market potential (size), and sales volume. One would argue that it is still easy to price such a new tractor in view of the fact that the company understands the business and has good track record.



Things get further complicated if one wants to set up a new business. Suppose you want to set up a coffee shop chain in one of the metros of India. You plan to set up five coffee outlets in the city. How will you find out your revenue for the first year? It may appear very easy to estimate revenue of this venture as the nature of the business is well known and customers are clearly identified. Even then it may prove difficult to value such entities. Suppose you obtain annual revenue, floor space of outlets, and number of outlets of your competitors in the same city for the past three years. It may be noted that obtaining these information is extremely difficult. Using available information, one may find out two relevant multiples: (a) revenue per outlet, and (b) revenue per square foot. Can the proposed new outlets use these multiple to estimate its first year revenue? If the average annual revenue per outlet of the comparable firms is Rs. 10 million, can the new entity estimate its first year revenue as Rs. 50 million for the five outlets together? The answer is a clear no. Expected revenue per outlet of the new business would depend on the location of the outlet. If an outlet is located in central business district (CBD), average footfall will be higher, but for a limited number of hours. Similarly, if another outlet were set up in a shopping mall, it would expect more customers than one in a residential area. However, the final decision about location of outlets will depend not only on the expected revenue from that area but also on the cost of renting that space. Though an outlet in a shopping mall will enhance the probability of higher daily revenue, the cost will also be higher. The unit economics may show that it would be prudent to set up the coffee outlets in a residential area where the contribution margin could be higher even with a lesser volume. Another advantage of having a coffee shop in a residential locality is long hours of moderate business. Such predictable daily business volume would help the outlet utilize its capacity and staff better. Therefore, the new entrepreneur will have to first decide about the location of the outlets before estimating daily business volume. Next issue that the entrepreneur will face is visibility. How to get the first customer into a new coffee outlet? Customer acquisition cost is quite stiff in such business and the entrepreneur may have to spend a sizable amount in initial years for promotion of its business to get the desired business volume. Interestingly, if the outlet is in the CBD or a shopping mall, a minimum business volume will be assured with no or moderate promotion. Therefore, it may be prudent for the entrepreneur to diversify the location of the proposed five coffee outlets to CBD, shopping mall and residential areas to maximize business volume.

The third example is a tricky one. This is an absolutely innovative business with no parallel. Suppose you have invented a portable brain-imaging machine that can do 50% of the job of a brain scanner at a much lower cost. The imaging machine uses Bluetooth technology to send image of a brain to a nearby hospital within a radius of 2 km. Such image will provide input sufficient for a neurologist to understand possible damage caused to the brain. Consider a road accident where a person having head injury with no external marks on the body was not immediately attended by the rescue team and normally sent home. Later the person may experience severe pain in the brain and develop symptoms of brain damage (e.g., vomiting, fainting). When that person was finally taken

to the hospital, he (she) may have lost life due to delay in treatment. The proposed brain-imaging device may save such patients. No one would disagree that it is a socially desirable business proposition and hence should be supported. Who will be the paying customer- the patient or a hospital or an insurance company? Patient will definitely not be a customer. A hospital will not have any incentive to buy such a device as it would have already invested in brain scanner, MRI machine, and other sophisticated devices. The insurance companies may be interested in such a product to minimize compensation claims on avoidable deaths. Therefore sometimes understanding who is your customer is a vital question and that will determine the potential revenue of the start-up. Should the founder therefore follow-up with the insurance companies with the MVP? Another related question would be on the business model. Is this a product or service business? Should the founders sell product or brain images? This is a vital question and the revenue estimation and fund requirement would depend on the business model. If it were a product business, revenue would be higher with associated problems of inventory management, logistics and distribution. If it is a service business, revenue would depend on usage of the device and upfront investment would be higher with longer gestation period for recovery of investment. The pay-for-service model would require additional investment in data storage and processing. The problem with valuing such ideas is that there is no comparable. The proposed device cannot be compared with a scanner and hence its business volume. Scanner would be far more efficient and hence costly. Also, the proposed imaging device is not a substitute for the scanner. Therefore, estimating the market potential and revenue of such devices using brain scanner, as benchmark would be extremely risky. Another problem with any medical device is that it needs certification of appropriate authority before it can be administered on any patient. Such certification in turn would depend on the use-cases. Therefore, the inventor of such a device would need to make dozens of prototypes and get some hospitals/ ambulance services use it for evaluating its efficacy. No one would talk about revenue till the idea is converted into an acceptable product that has got 'satisfactory' certificate from users.

The above examples highlight that it would be futile to try to value any new idea without an MVP. What is required at the stage of idea is to evaluate (a) what is unique in the idea? (b) is it possible to get a viable product from the idea; (c) how much investment would be required to get the first ten customers? It is only then one can think about valuing an idea. So, a winning idea will be funded on the strength of the team and how quickly it can be taken to the market. No valuation is necessary at this stage.

The next part will discuss valuation of pre-revenue companies.

# Health or Wealth? An Automotive Dilemma

**Samit Paul**



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The debate on ‘environment vs development’ is undying and in spite of various polarized views on this debate, the world is always looking for a sustainable trade-off. Gradual change of climate, especially global warming, is a continuous threat towards the society. Hence, committed efforts from all stakeholders across countries are highly desired to achieve that trade-off. Further, phenomenal increase of air pollution caused by the vehicular emission has compounded the problem. India, in last few decades, has experienced a massive growth in automobile industry<sup>1</sup> and thus gets acutely affected by the menace of air pollution. As a controlling measure, the regulatory authorities have mandated vehicles to adhere to the certain standard norms of emission.

These standard norms have been evolved since enactment of ‘Bharat’ Stage (BS), the set of emission standards established by the Government of India to curb emission from motor vehicles. BS I and II were introduced long back in 1999-2000. Afterwards, mass-emission standards BS-III and BS-IV had been laid down in 2009. Each such progression denotes stricter norms of emission. Although India had been following BS-III regime from 2010, it had to take a shift to BS-IV regime by April 1, 2017. The progress of India in this regard is still lagging behind than its western counterparts as the developed nations had moved onto Euro 4 (January, 2005), Euro 5 (September, 2009) and Euro 6 (September, 2014). In view of this, on March 29, 2017, the Supreme Court of India took a significant step by placing a ban on registration and sale of BS-IV non-compliant vehicles on and after April 1, 2017. However, the issue of whether the accumulated inventory of BS-III compliant motor vehicles manufactured on or before March 31, 2017 can be sold from April 1, 2017 onwards had been raised before the Supreme Court. The arguments in favor of such demand cited ‘weak market forces’ and ‘demonetization’ as potential barriers for clearance of stock. Moreover, the past two instances<sup>2</sup>, where industry was allowed to offload accumulated stock even after the timeline, had brought into notice. However, this argument was refuted by the Supreme Court and the ban on sale of BS-III compliant vehicles has been sustained.

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<sup>1</sup> The automobile sector alone contributed 7.1% of India’s overall GDP, 4.3% of overall exports and was accounted for 8% of India’s entire R&D expenditure in 2014 (GOI, 2016)

<sup>2</sup> After the cut-off date of April 1, 2005 BS-I and BS-II compliant vehicles and after the cut-off date of April 1, 2010 BS-III compliant vehicles were permitted to be sold, until the stock had been exhausted

**Immediate reactions:**

The apex court's order to ban BS-III vehicles appeared as a 'shock' for the automotive industry. It created an initial panic and some uncertainty over inventory of vehicles, their registrations and piling up stocks at the Original Equipment Maker's (OEM's) stockyards. Mahindra and Mahindra released a statement stating that the 'unexpected ruling will have a one-time material impact.' Tata Motors, the largest commercial vehicles manufacturer in the country said in a statement:

*"The Supreme Court order banning sale of all BS-III vehicles from April 1 is an unexpected and unprecedented move that will have a material impact on the entire automotive industry, OEMs' and dealer networks and is a penalty to the entire automotive industry..."*

This sudden decision had left industry with two choices: either to export the existing BS-III vehicles after offloading maximum in three days (29 March, 2017 – 31 March, 2017) while providing heavy discounts to the customers or to upgrade the entire lot of BS-III into BS-IV compliant vehicles. The issue with the second option, i.e. to upgrade the vehicles to meet newer norms, was that it required huge time and resources to modify the engines and also there was lack of availability of BS-IV compliant fuel.

President of Society of Indian Automobile Manufacturers (SIAM) and MD of Ashok Leyland, Mr. Vinod Dasari commented: *"While no one pushed for BS4 fuel availability for 7 years to change over faster, this sudden decision – just a few days before the changeover - is rather unfortunate as it causes undue stress on the entire industry, and causes loss of jobs. Auto Industry, anywhere in the world, requires a stable and predictable policy which allows for long term planning and investments"*.

Another statement released by the industry representing body, SIAM, stated:

*"Auto Industry is law abiding and is in full compliance with the emission norms set by Government that stipulates date of "Manufacturing". The historical implementation of emission norms also reinforces the current law that stipulates "manufacturing". Auto Industry has had the capability of making BS4 vehicles since 2010, but lack of proper BS4 fuel prevented it from selling such vehicles, nationwide. Running a BS4 vehicle with BS3 fuel can cause severe problems to some vehicles."*

Despite such reactions from the market players, few players had been found to be proactive in this respect. For example: Toyota had implemented BS-IV technology a year back and was least affected by such ban. Few auto companies even welcomed this decision. Chairman, MD & CEO of Hero MotoCorp, India's largest two-wheeler manufacturer, Mr. Pawan Munjal said:

*"I welcome this move by Supreme Court in the interest of public health. Hero MotoCorp, recognizing the need of the hour, carefully planned a proactive move to switch from BS III to BS IV compliant products across all our range well in time and have been producing only BS IV compliant products since one month before the given*

*deadline. We have reduced our BS III inventory significantly in the past few months with the aim to minimize our stakeholder losses."*

### **Actual impact:**

#### *Impact from Discount Offered:*

The commercial vehicle segment produced large inventory and continued manufacturing BS-III vehicles till March with the expectation of higher sales in April given the expected price increase of 8 - 10% on BS-IV vehicles. As per the CRISIL report, the cost of heavy discounts and incentives for commercial vehicle manufacturers amounted to INR 1,200 crore (approx) till March 31, 2017. In addition, INR 1,300 crore had been incurred as a cost of disposal of the unsold inventory (including exports). Although, the commercial vehicle segment experienced an impact of 12% value on inventory, pure player like Ashok Leyland was most affected. Others like Tata Motors or Eicher had been cushioned by their other product offerings.

The impact on two-wheeler segment and passenger car segment were quite insignificant. Two wheelers, such as BS-III bikes and scooters were sold with discounts up to 30%. ICRA estimated the loss faced by this segment due to discounts to be around INR 600 crore. On the other hand, the passenger car segment stayed largely unaffected as it had mostly shifted to BS-IV regime from beginning of last year. But 10-30% discounts and freebies assisted the dealers to clear most of the stocks in last three days of March.

#### *Impact on Inventory:*

According to the CRISIL report, the impact of ban on the level of inventory was comparatively low for the companies like Bajaj Auto, Yamaha and Eicher as they had already upgraded their inventory to BS-IV from January 2017. Even market leader Hero Moto Corp, and two others, namely Honda and TVS Motors, had upgraded most of their models before the ban set in. The report mentioned that 25% of the banned vehicles are expected to go to exports. At the time when the ruling came, the two-wheeler segment was holding an inventory of 6,70,000 BS-III models amounting to INR 3,800 crore which is approximately half of monthly sales of the automobile industry.

#### *Impact on Estimated Profit:*

To address the challenge of placing unsold inventories, the companies started exploring export markets and converting the vehicles to BS-IV. The cost of the vehicles increases by 8-10% in the process of conversion. According to the research firm Nomura, the Net Profit margins of the automobile firms had been impacted by this ban and the estimations are as shown below in Table-1:

**Table 1: Net Profit Impact (as estimated)**

Inventory (Units)	Total Cost (Cr)*	Name of Company	Net Profit (estimated) FY 18 (Cr)	Net Profit impact (%)
18,000	281	Ashok Leyland	1,435	19.6
11,300	149	Eicher	2,274	6.6
20,015	162	Mahindra & Mahindra	3,722	4.4
300,000	163	Hero MotoCorp	3,844	4.2
75,000	381	Tata Motors	14,249	2.7
65,000	9	Bajaj Auto	4,469	0.2
* Net impact after exports, retrofitting, discounts and inventory carrying cost				

Source: Nomura Research

#### Impact on Stock Market:

On the date of announcement of the ban, the automobile market reacted negatively as expected. Although BSE Sensex and NSE Nifty were up by 73.96 points and 25.55 points respectively on that day, S&P BSE Auto sector and S&P Nifty Auto were down by 186.89 points and 42.05 points respectively. More specifically, those automobile manufacturers who had large amount of unsold BS-III vehicles in their inventory experienced a major blow. Table 2 lists down the stocks which had been significantly affected by the decision.

**Table 2: Changes in Stock Prices**

Company	% Change
Hero MotoCorp	-3.67%
Ashok Leyland	-2.66%
Bharat Forge	-1.13%
Eicher	-1.08%
Tata Motors	-0.95%
Maruti Suzuki	-0.65%
Mahindra & Mahindra	-0.61%

Source: [www.zeebiz.com](http://www.zeebiz.com)

Overall, it has been found that the shareholders of automobile industry had suffered an erosion of INR 88,390 million (approximately) in their wealth on the day of announcement of ban on BS-III vehicles. These results clearly indicate that the investors penalized the industry for its 'wait-and-watch' approach and lack of proactivity.

**Challenges ahead:**

When the debate on ‘environment vs development’ turns into a debate on ‘health vs wealth’, it is quite imperative that the stakeholders would give preference to ‘planet over profit’. On this particular event of banning BS-III compliant vehicles, the decision taken by Supreme Court of India shows the long term vision and priority of the apex court in achieving health of India. According to the experts and environmental bodies, moving from BS-III to BS-IV regime would significantly reduce overall pollution in the cities which have become notorious toxic chambers of vehicular emissions. Apart from demonstrating nobility, the decision carries significant managerial implications for the automotive industry. The quote from Ms Anumita Roy Chowdhury, Executive Director of Centre for Science and Environment (CSE), on ban of BS-III was as follows:

*"This is a significant step forward as this gives the message and the lesson that the automobile industry will have to walk the extra mile to address the expansive concern around public health and not weigh down the transition by taking a very narrow technical view."*

At this juncture, such comment is more relevant as India has already decided to move to BS-VI compliant regime by 2020 while skipping BS-V. Expectedly, this will lead India achieving emission standard as par developed countries. However, the path is not so smooth. The automobile industry of India should now shift gears and need to be more proactive in adopting state-of-the-art green technology to manufacture BS-VI compliant vehicles. If such up gradation can be treated as an investment for a healthy future, then only a giant leap towards sustainable development can be possibly attained.

## ALUMNI CORNER

# Central banks act in tandem to unwind a decade of easy money

**Balachandran R**



*Balachandran R is an alumnus of IIM Calcutta (1987-89) with extensive experience in corporate banking, investment banking and product management.*

Long before the Great Recession that struck the United States in the aftermath of the financial crisis, Japan was in the throes of a multi decade era of low growth and deflation following a boom and bust phase. Years of zero or negative interest rates failed to move the needle on inflation. Emerging market denizens perennially worried about high inflation eating into savings and affecting purchasing power, may wonder what the fuss is all about. Noted economist Paul Krugman explains in a New York Times post that deflation causes people to spend and borrow less thereby keeping the economy in a depressed, deflationary trap, raises real debt levels and leads to fall in wages though he also highlights downward nominal wage rigidity. Therefore goal of monetary policy is not price reduction (negative inflation) but price stability, in other words low and stable inflation. Detractors of Keynesian economics may of course, disagree on the demerits of deflation.

The United States too has been struggling to reach its inflation target of 2% ever since the 2008 crisis. Bringing down the Federal funds target rate to 0% and asset purchases through the New York Fed resulting in a balance sheet of \$4.5 trillion dollars, did not help in moving up inflation.

The European Union too has been struggling with poor growth and again low inflation. Apart from the ripple effects of the financial crisis originating in the US, the EU saw one debt crisis after another spanning across Portugal, Italy, Ireland, Greece and Spain. The European Central Bank brought down interest rates below zero and resorted to massive asset purchases to revive the economy.

Until recently, the effect of the central bank intervention globally, appeared to have had the primary effect of inflating asset prices, with stock indices touching all time or multi year highs, be it the Dow Jones, Nikkei, Hang Seng or other market indices. But inflation and growth remained below expectations.

### **The tide turns**

Starting with the US, the news from all the major economies in the world has turned positive since the middle of 2016.



The January 2018 statement issued by the Federal Open Market Committee which decides monetary policy in the US, cites continued strength in the labor market, economic activity rising at a solid rate and low unemployment rate. Inflation is expected to move up and stabilize around the Committee's 2% objective in the medium term. Earlier in June 2017, the FOMC laid out a calendar for a gradual winding down of the Fed's massive holding of \$4.5 trillion of Treasury securities, agency debt and mortgage backed securities built up during the quantitative easing phase, up five times from its pre-crisis balance sheet level of \$900 billion. But the recent tax cuts approved by the US Congress is in effect a \$1.5 trillion dollar stimulus which can exacerbate inflation. The latest job growth numbers for February 2018 was beyond expectations. The market expects that the FOMC could go beyond the projected three rate increases this year. 10 year Treasury yields have surged to 2.9%. Yields reaching 3% are considered a line in the sand for financial markets.

At Japan, while the short term policy interest rate continues to be in the negative, the Governor of the Bank of Japan, has started taking of an end to monetary stimulus from next year, something which was practically heresy till now. The central bank now expects inflation to reach its 2% target in fiscal 2019. Unemployment rate has fallen to multi decade lows. The central bank has an upbeat view on the economy now.

The European Central Bank joined the other major central banks in dropping its easing bias. In a surprise tweaking of language in its March 2018 monetary policy statement, which is closely watched by the financial markets, the ECB dropped its previous commentary that "it stands ready to increase the asset purchase program if the outlook becomes less favorable or if financial conditions become consistent with further progress towards a sustained adjustment in the path of inflation". The move was unexpected given the political uncertainties stemming from the rise of the anti-European Union parties in the Italian elections, trade wars stoked by the US, and volatility in stock and bond markets. Despite these headwinds, the central bank has a more positive view of growth prospects for the euro zone. The quantitative easing program stands to tentatively end by September this year.

The world's second largest economy China has different set of challenges stemming from high levels of debt and fiscal deficit. While no major changes in monetary policy is expected in 2018, the government projects moderate growth in the economy and has vowed to cut fiscal deficits, while keeping monetary policy neutral.

### **Is India's Central bank behind the curve?**

India faced below target inflation, at 1.5%, during a very small window during the year 2017. The Reserve Bank of India faced flak for not reducing rates in line with falling inflation and failing to support growth. Since then, the surge in oil prices and the increase in consumer price index based inflation consecutively over six months have silenced the critics of the RBI. The vindication of RBI/Monetary Policy Committee's stance in holding on to rates would have provided an opportunity for the central bank to crow about it, in its latest monetary policy statement; however the tone of the statement was measured.

The recent relentless rise in the 10 year benchmark security's yield to 7.7% (the previous benchmark is close to 8%), has caught most market players by surprise. The yield was barely 6.5% six months back. With the policy rate i.e. repo rate unchanged during this period, the differential between policy rate and benchmark yields has widened to 1.7%. Some would interpret this as a signal that policy rate increases are just round the corner and/or behind the curve. Oil prices have moved by more than 30% in six months adding to inflationary pressures and current account deficit. Fiscal deficit slippage, increase in Minimum Support Price for crops, expected HRA increases by state governments, normalization of monetary policy by advanced economies have all clouded the outlook for inflation in India. The banking frauds that have come to light recently have added further uncertainty to the financial markets. The only saving grace for an import dependent nation, so far has been the Rupee, which is still way below the levels reached during the 2013 taper tantrum days. A stronger currency makes imports less expensive in local currency terms. While central banks in advanced economies have been struggling to increase inflation, India after a brief pause, is back to fighting the inflation monster.

### **Central bank speak!**

The erstwhile Governor of RBI Raghuram Rajan called for greater monetary policy coordination from central banks of major economies, especially in managing spillovers on emerging economies while winding down the long phase of monetary expansion, drawing from the lessons of the 2013 taper tantrum episode under Ben Bernanke when emerging market currencies suddenly plummeted. While we have not witnessed central banks getting into a huddle prior to announcing monetary policy (which of course is the prerogative of the monetary policy committees of the respective regions), their almost uniform action over the last few months towards ending the decade long phase of loose monetary policy, is a sign of return of inflation and growth in an inter connected global economy and the near identical mindset of the central bankers. Perusing the monetary policy statements of the respective monetary policy committees across advanced and emerging markets, reveals almost indistinguishable language; call it "central bank speak" !

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**VOICE OF AMERICA****Who Do We Blame?****Ayan Bhattacharya**

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For the past few weeks, India has been fixated on the Nirav Modi-PNB saga—with every passing day exposing some new or unexpected affront of the regulatory system. Investigative authorities have finally begun swooping in on the details, and like every time, there is the hope that at least this time, the guilty would be brought to book. At the heart of this, or, for that matter, any other investigation lies a basic assumption: that the sleuths, judges, juries, authorities—and even suspect—understand and agree on the rules of the game. But imagine a world where no one fully grasps the rules underpinning the system—this, increasingly, is the world of financial markets manned by sophisticated, intelligent algorithms. Now if something goes wrong in such a world, who do we blame?

**1. Learning the Rules of the Game**

How do societal rules arise? This question has a long, rich history that has spawned entire fields of study, like Sociology. Within economics too, there is a vibrant tradition of research on this question. While different schools of inquiry differ on the finer details, at the broad level, there is consensus that the rules are a form of context-dependent equilibrium that help us to do well as a community.[1] Think of it this way: if we did not have traffic lights, there would be many more accidents. Traffic lights also work because we drive cars on flat 2-dimensional surfaces—that is the context. If and when we all start driving drones in 3-dimensions, our traffic system will have to evolve. Because social rules are conditional on context, they depend crucially on our learning and state of knowledge. If we did not have the technology for cars, and our only mode of transport was walking, we would not need traffic lights! The world that we inhabit has not changed much in the past few hundred years, yet our social rules have evolved enormously because we have learned more and more about ourselves and the world.

Learning is so innate in us humans that we seldom marvel at the enormous complexity of the process. Researchers, for many decades, have struggled to understand and replicate the intricate cadence that underlies human learning;

yet even now, our grasp of the process is shaky. In the last few years, however, we seem to have uncovered a few basic principles that underpin practical learning. Whether these are the same principles that animate human learning, no one knows for sure; yet there is increasing evidence that these principles do produce a flavor of learning. In particular, two important ideas lie behind the explosion in algorithmic learning applications in the last few years: deep-learning, and, increasingly, self-learning.

## 2. Learning Deeply, On Your Own

A popular technique to increase one's skill at chess, in the early stages, is to play against oneself. The idea is that as your own opponent, you will create some small variation, to which you will learn to respond optimally – increasing your feel for the game. It is this intuitive idea that motivates the principle of self-learning. If the space of strategies of each player is sufficiently well-behaved mathematically, it is possible in-principle to learn the game fairly well by playing against oneself.[2] For example, think of a simple “Guess an integer” game, where you and your friend sequentially announce a positive integer between one and one billion; each integer that is announced has to be higher than all previously announced integers; and the winner is the one who can make the last announcement. You don't really need to play against a friend to understand how best to play this game. Very mechanically, you can assume simple variations for your friend's play (say, for instance, you can assume that your friend will always guess one higher than you—so when you guess 2, he will guess 3) and exhaust all possibilities for the game. The big problem, however, with such a brute force mechanical approach to self-learning is that it takes an awful lot of time. Even for mathematically well-behaved strategy spaces, the time bottleneck is impractical. For self-learning to work, therefore, we need insights about the data that can cut through the fluff and guide us on how we select our hypothetical opponent's strategy.

The constellation of techniques that go under the name of deep-learning has been around since the 1960s, but crucial breakthroughs beginning in the late-2000s made the approach practical (for example, [3]). The basic idea is to have multiple layers of connected nodes (like human neurons) in a hierarchy, with each layer focused on a certain level of abstraction, and the output of a lower layer serving as input for the subsequent higher layer. So given a game of chess, the lowest layer might recognize just the board and pieces, the next layer might use this input to identify legal moves in the game, the layer after that might begin to recognize “good” moves, and so on. As each further layer in the hierarchy recognizes more and more abstract features, the strength of inter-connections in the lower layers are re-adjusted to better reflect the overall interpretation. Gradually, as the process gorges on more and more data—adding and subtracting inter-connections in various layers on the way—the network begins to “understand” the game. At the big picture level, deep learning is a technique to generate deep insights that requires copious amounts of data.

Now let's put the two and two together. Self-learning generates a lot of data but needs insights about the data to work successfully. Deep learning generates insights but needs bountiful quantities of data to work well. So what is the obvious conclusion? Self-learning and deep learning seem just made for each other! Well, not really, because the real world has innumerable stochastic variables that are highly unpredictable.[4] Think, for example, of a sudden pothole that may emerge in the path of a self-driving car due to unanticipated rain the previous evening. Nevertheless, in certain special settings, the match between self-learning and deep-learning is indeed strong. These are settings where the rules of engagement are clearly defined, and the majority of players use similar algorithmic techniques. In other words, financial markets!

### 3. The Financial Market Black Box

If there is one field outside of computer science where algorithmic techniques are having an outside impact, it is finance. Financial markets present a relatively manageable, controlled environment, which is nevertheless sufficiently rich to present many interesting challenges. Not surprisingly, outside of Silicon Valley, Wall Street firms are among the biggest recruiters of tech talent.[5] At the same time, recent techniques in artificial intelligence and algorithms build on the tools of game theory. Game theory, incidentally, has been the bread and butter of serious economists for many decades. Thus a two-way street seems to have opened up between computer science and economics & finance that is gradually changing the contours of both fields.

Going back to our topic at hand, in a market where traders are self-taught, deep-learning networks, if something goes wrong, how do we know who to blame? In order to assign guilt, we need to understand the motives of the guilty. But self-learning/deep-learning networks are closed loop black boxes where we neither understand how the data for learning is generated, nor how the insights about trading decisions are arrived at. Self-learning and deep-learning, in tandem, are almost a self-regulating structure that brooks no outside intervention. It is quite possible that market outcomes which appear deviant to us, might in fact be stepping stones to smart trades. But we have no way to know. Going back to our old example, algorithms might be capable of 3-dimensional drone maneuvers while we are still stuck in our primitive 2-dimensional traffic lights.

The rules that we have defined for our markets reflect our human capacity for learning. If such markets were inhabited by artificially intelligent algorithms (as they increasingly are), how must we create the rules – especially when algorithmic learning is a black box to us?

#### 4. The Opportunity

Strangely, though the present algorithmic setting is completely novel, this is not the first time humans have grappled with such questions. Ancient traders faced the same question when they landed on an unfamiliar shore, and you and I face the same question when we adopt our first pet. In fact, whenever two distinct cultures of learning come into contact for the first time, we almost always grapple with such questions. Though it appears far removed, the clues to a solution to our ongoing algorithmic conundrum might lie in such encounters. From history, we have learned that exchanges between adherents of distinct styles of learning have proved most successful when there has been no imposition. Instead, what works is a shared system of ethics, and a commonly accepted system of values within which everyone operates. Thus we have concepts like democracy, privacy, morals and universal rights. A nascent movement in the algorithmic community towards these ideas is already underway.[6] Going back to our traffic analogy, what we really care about is no accidents, not the specifics of any particular traffic system.

Most of these ideas are still in their infancy and only vaguely understood at the present time. As we map out this new and unfamiliar algorithmic terrain, a lot of academic and real world fortunes will be made. After all, every one of us wants a Nirav Modi to stand trial, even if he were an algorithm!

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[1] Herbert Gintis, “The Bounds of Reason. Game Theory and the Unification of the Behavioral Sciences,” Princeton University Press, 2009.

[2] Noam Brown, Tuomas Sandholm, “Superhuman AI for heads-up no-limit poker: Libratus beats top professionals,” Science, January 26, 2018.

[3] Krizhevsky, A., Sutskever, I., & Hinton, G. E. (2012). Imagenet classification with deep convolutional neural networks. NiPS12, pp. 1097-1105.

[4] Joshua Sokol, “Why Self-Taught Artificial Intelligence Has Trouble With the Real World”, Quanta Magazine, February 21, 2018.

[5] Nanette Byrnes, “As Goldman Embraces Automation, Even the Masters of the Universe Are Threatened,” MIT Technology Review, February 07, 2017.

[6] Kevin Hartnett, “How to Force Our Machines to Play Fair”, Quanta Magazine, November 23, 2016.

**MARKET WATCH****The Billion-Dollar Fraud That Shook The Nation**

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Public Sector Banks (PSBs) in India had for long been the poster boys of steady growth in the country. The customers seemed happy with the healthy returns they got on their deposits, stashed away safely – largely insulated from market risk. The bankers were content with the stability, esteem and relative autonomy associated with their job. The government too was satisfied – conveniently piggy-backing on the banks for financial integration of the rural population, tax collection on fixed deposits and what not. The regulators didn't have much to worry about either, with their capital adequacy ratio norms (stricter than the global Basel norms) being comfortably complied with by Indian PSBs.

But then, things started going wrong. The PSBs had avoided putting the depositors' money at risk by staying away from the risky investments that mutual funds and the like are typically known for. They had instead lent it out to corporates (going concerns believed to have robust payback capabilities) and aam junta (with collateral and/or human guarantee sufficient to enforce recovery), hoping to get it back with interest on time. What had skipped everyone's attention was that market risk wasn't the only type of risk at play – credit risk (manifesting itself in defaults) and operational risk (resulting in frauds) were equally dangerous adversaries.

No other case brought credit risk to the fore like that of Kingfisher Airlines, which was found to owe over 9000 crore in loans to 17 banks – a large majority being PSBs. Given the glamorous reputation of the accused owner and the colossal sum of money involved, the case stoked interest among the media houses and was readily lapped up by them. The common man – with the willingness to pay (WTP) but often devoid of the requisite ability to pay (ATP) – was found hard-pressed, while the affluent – often possessing the ATP but lacking the WTP – seemed to get away scot-free. This realization enraged the aam junta, who felt marginalized.

Still smarting from the Kingfisher revelation, the people of the country were in for another rude shock less than 2 years later – this time inflicted by the other nemesis called operational risk. On 13th February 2018, Punjab National Bank filed complaints with the CBI and the Enforcement Directorate (ED) alleging that 3 Mumbai-based private companies (including Gitanjali Gems) had connived with PNB officials to fraudulently obtain unauthorized Letters of Undertaking (LoUs) and Foreign Letters of Credit (FLCs) that were subsequently used to acquire funds from foreign branches of other Indian banks. Since LoUs and FLCs practically serve as guarantees,

*\*(Any opinions expressed in this piece are personal and may or may not be endorsed by any of the bodies/organizations I'm associated with.)*

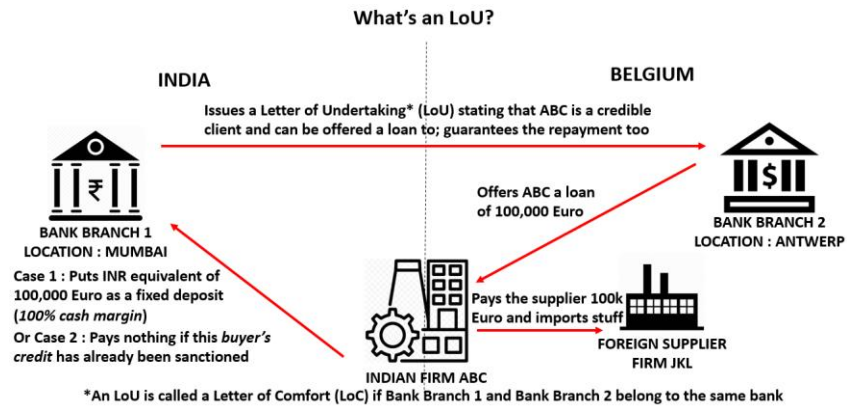
PNB claimed it was liable to pay back an outstanding amount of almost USD 750 million between February and July 2018 if the beneficiaries defaulted.

Unfortunately for PNB, the event of a default however wasn't as stochastic in this case as it usually is. It was a foregone conclusion the moment the fraud came to light, given the modus operandi employed by the perpetrators – as explained in the FIR registered by the CBI. To understand it, let's take a simple example. Imagine you take a loan of INR 10,000 from a bank to buy yourself a phone. When it's time to repay the loan, you borrow another INR 12,000 from the same bank and use most of that amount to settle the previous debt. Again, when you need to repay the second loan, you take a third one and use it to settle the second. This ensures that you never default on a loan, even though you never set aside your own funds to repay it either. Things fall apart the moment your bank refuses to issue a fresh loan, thereby breaking the cycle.

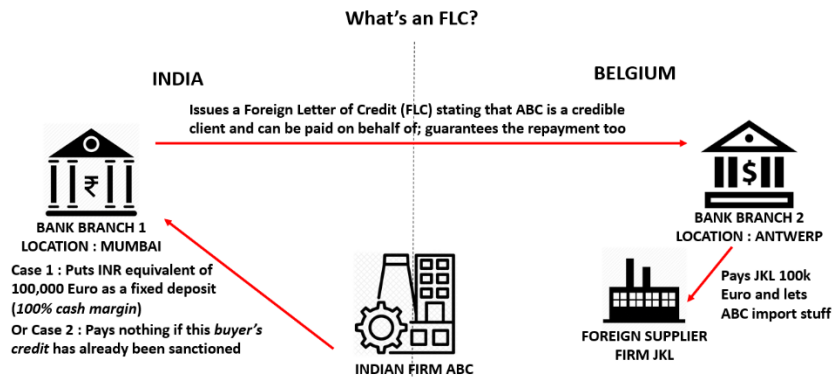
The above serves as a layman's explanation of what's believed to have secretly gone on for almost 8 years in PNB before being discovered in 2018 to everyone's horror. A couple of PNB insiders are alleged to have exploited a glaring loophole in the book-keeping mechanism of the bank to facilitate this swindling. The loophole involves 2 of the most important systems at the disposal of any PSB – CBS (Core Banking Solution) and SWIFT (Society for Worldwide Interbank Financial Telecommunications). The CBS works on an intranet within a bank and is, among other things, used to record all financial activities involving the bank. SWIFT works on the internet and is used to send electronic messages from one bank to another for, among other things, intimations about issuance of LoUs and FLCs. Traditionally, the 2 systems operate independent of each other – partly to ensure the safety of the data on CBS and partly due to lack of will for a tedious upgrade. Within a branch, even the computers used to operate the two are often different. This lack of linkage between CBS and SWIFT means that a manual entry (eg. – for the issuance of an FLC/LoU) first needs to be made on CBS, and only then a message intimating the other bank is to be sent through SWIFT. Performing only the latter step would essentially intimate a foreign bank of the LoU/FLC without ever recording its issuance at the issuer's end. This is exactly how the fraud is understood to have been carried out.

In addition to the glaring transgression of not recording LoUs and FLCs on the CBS as described, there are several finer rules that were flouted in this entire charade. A cash deposit of 100% or more (i.e. to get a loan of \$1000 from a foreign bank branch in the US, you need to deposit its INR equivalent or more – as per the rules of the issuing bank branch – back in India at prevailing exchange rates) is needed to obtain an LoU/FLC, unless the credit has been especially sanctioned by the bank. There was no sanction by or





*Figure 1: Simple schematic explanation of an LoU*



*Figure 2: Simple schematic explanation of an FLC*

cash deposit at PNB in this case. Import documents (with supplier details) too are typically required to be submitted as proof for what the funds sought are needed for. Such documents were never asked for either. Also, the RBI had stipulated that LoUs/FLCs issued for the import of rough, cut and polished diamonds could have a maximum credit period of 90 days (only 'clean credit' for import, i.e. one obtained without guarantees in the form of FLCs, LoUs etc., could be for a maximum period of 360 days – that too in special cases). However, all the FLCs and LoUs issued in this case were for a period of almost 1 year, thereby violating the norm. This has also brought under the scanner the foreign branches that acted on the FLCs/LoUs to release funds, since it's strange even they didn't notice that the FLCs/LoUs weren't as per norms. The fault is not restricted to just the accused PNB officials and the foreign banks, though, as the rest of this paragraph may seem to suggest – the borrowers too have obviously been identified as culprits. In addition to being complicit in getting the fraudulent LoUs/LCs issued, they are also accused of not using the funds for the purposes they were issued for and instead utilizing them to settle old debt among other things.

The case has had plenty of repercussions, unsurprisingly. CRISIL has added the negative remark of 'rating watch with developing implications' to its outlook on the creditworthiness of various types of bonds issued by PNB.

Taking cognizance of the modus operandi of the fraud, the RBI has instructed all PSBs to link their CBS with SWIFT by the end of April and has also banned the issuance of LoUs altogether. PNB now runs the risk of being taken under RBI's Prompt Corrective Action (PCA), which will restrict the bank's lending capacity, infrastructural expansion and workforce growth. As for the share market, it seems to have been caught completely off guard. In fact, just before the first maturation (since the fraud began emerging) of fraudulent LoUs happened on 25th January, the PNB share seemed to be in great demand – the traded volume increased almost 350% and the share price went up 11% all in a matter of just 2 BSE sessions. The market continued to carry on blissfully unaware till PNB officially provided it with price-sensitive information under Regulation 30(6) of SEBI's Listing Obligations and Disclosure Requirements (LODR). The intimation on 14th February about the fraud's magnitude being almost 11000 crore sent shockwaves across the market. It led to the traded volume going up about 1150% and the share price falling almost 21% in as few as 2 BSE sessions. The next intimation on 26th February (about the possibility of an additional 1300 crore getting added to the fraud's monetary value) led to similar panic, with the traded volume increasing 370% and the share price going down 12% in a single BSE session. Overall, the share price has plummeted from a high of 194.55 on 24th January to almost half that number, and will be closely watched going ahead pending further developments.

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