

PLAN FOR A SPECULATION

THE NORDENSKIÖLD MODEL:

PLAN FOR A SPECULATION

Goldin+Senneby with

Pamela Carter (Playwright)

Ismail Ertürk (Senior Lecturer in Banking)

Donald MacKenzie (Professor of Sociology)

Peter Hägglund (Managing Director, IFL Executive Education)

Stefan Marling (Actor)

Fredrik Meyer (Actor)

Eva Rexed (Actor)

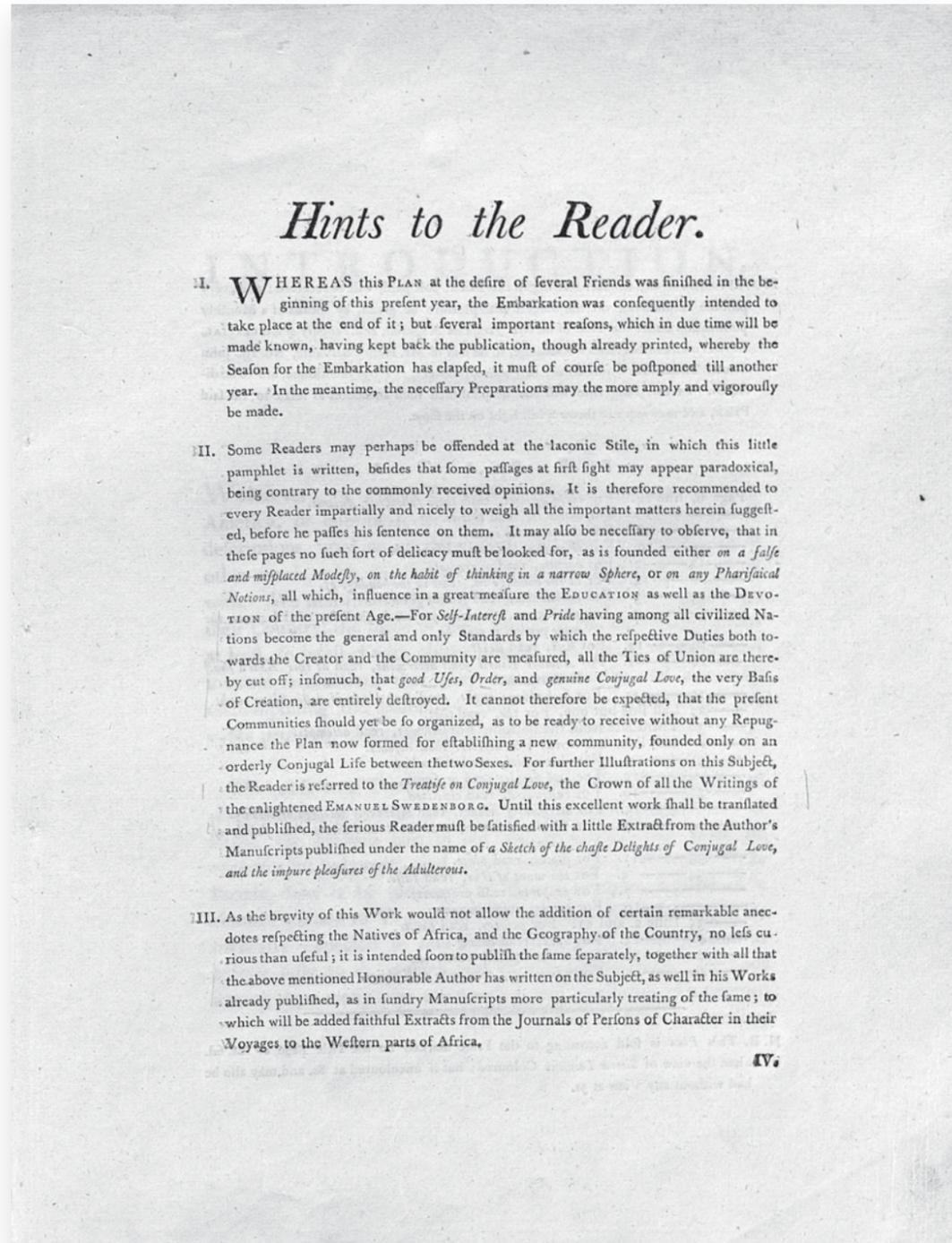


fig. 1
page 3, "Plan For a Free Community", August Nordenskiöld, 1789

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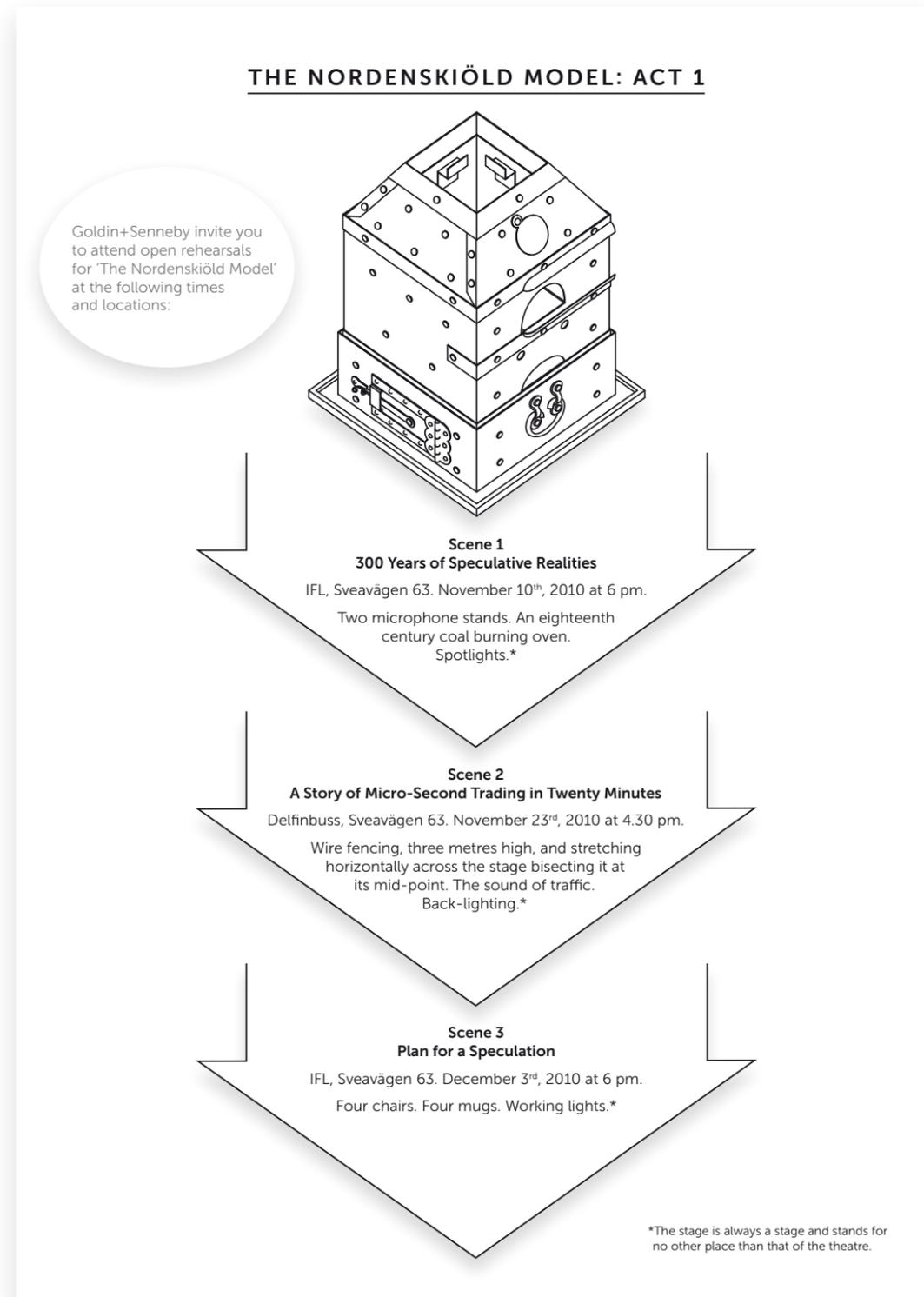


fig. 11
Rehearsal schedule: "The Nordenskiöld Model: Act 1"

300 YEARS OF SPECULATIVE REALITIES

Pamela Carter
With lecture by Peter Hägglund

The lecture theatre. There is a single microphone at a lectern.

Simon and Jakob stand on stage. They watch the audience as they enter and settle in seats nodding and waving to those they recognise.

An usher approaches the stage to give them clearance from front of house. Simon approaches the lectern. Jakob invites Peter Hägglund to join them.

Simon taps the microphone, coughs, and speaks into it.

Simon: Hello. Good evening everybody.

And welcome to 'The Nordenskiöld Model' by Goldin+Senneby;
Act 1, Scene 1 ... '300 Years of Speculative Realities'.

Hi. My name is Simon Goldin.

He turns to Jakob.

(to Jakob, off mic) Jakob ...

Simon lets Jakob take the mic, smiles encouragingly at Peter.

Jakob: (to Simon, off mic) thanks ...

Hello. My name is Jakob Senneby. And we are Goldin and Senneby.
We're very happy to be here, and very happy to see you all here. We're glad you could make it. Thank you.

And we'd also like to thank the institute for business management ... our hosts ... and particularly Peter Hägglund. Peter is CEO of the institute. Thank you for making space for our play in your home of learning and business.

Jakob and I, we're artists ... we're in the business of art, I guess.
And tonight we're at the beginning of a new project ... a new venture even ... 'The Nordenskiöld Model' ... where we'll be getting into the business of finance and theatre.

Simon whispers to Jakob.

Yes. We'll be impresarios ... theatre impresarios ... entrepreneurs ... we'll become wildly rich ... anything is possible ... it's about belief, yes?

Simon nods.

Ok. That's speculation ... but this we know for sure ... tonight, Simon and I have something to show you.

Simon: (to Jakob, off mic) Not yet.

Jakob: But not yet. Simon and I have something to show you all but before we do ...

When Peter Hägglund agreed to have us here we asked him if he'd consider giving a talk as part of this inaugural event and we're delighted he accepted. Peter is CEO of the institute and also an expert in the field of models.

We like models ... Simon and I. We're interested in models ... how they describe the real world we live in ... how we use them ... and how they might generate new realities in their image.

So please welcome ... Peter Hägglund.

Simon and Jakob invite Peter to take the mic and retire to chairs at the side of the stage. Audience applause. Peter Hägglund turns on the opening slide of his Power Point with a remote control: "Financial Instruments' Performativity on the Financial Markets".

Peter: Thank you very much. And welcome here... tonight. Now the question is: How do instruments like financial models affect the world and us? That is the question. And I first became interested in this... financial models... when I did my dissertation work. Originally my interest was about how traders and analysts communicated with each other. And it turned out that financial models were a very important part of that communication, so I started to study the subject... a bit more...

Audience: Could you speak up a little?.

Peter: Yes, of course... Yes, of course I can.

Now continuing louder

It's... I became very much involved in how these markets were functioning and especially... how this information was structured. And it turned out that as these financial models were such an integrated part of how they communicated, I was very hooked on the subject of how financial instruments perform on the financial markets. Financial instruments' performativity.

Now performativity... that's a very beautiful word. It comes from speech theory and it indicates a capacity to intervene in the course of human events... to intervene in the course of human events.

Some things we say, should not be judged upon if they are true or false, but rather: how do they perform? And one of the most clear examples of that is when we say things like 'this meeting is adjourned'. The very act of saying these things makes the course of history a bit different... in that case not very different... but for the people in the room, it makes them change their plans, it makes them do something. So it performs upon us.

And the financial instruments... they do perform something on us. They perform upon a society. So now this is a perspective that suggests that financial instruments, that we create, are actually actors on their own. They act... and when they act we have to re-act.

Let's look at the question now: How do these instruments perform on us? And first of all I need to start with saying that these instruments create stability on the financial markets. Most of what they do is very very positive. We can look at instances where we've had no instruments at all, where the models were non-existent and we will see things like this...

Peter switches to his next slide: "Tulip price index 1636-37"

This is from the 1637 tulip mania. It actually started in November 1636 and it went on for three months. The tulips had just been introduced in Holland and they were the rage. Everybody talked about them. Everybody wanted them. The price... more than tripled in a couple of months... But these are official data. We know that there were prices that were paid that were so much more than this. Uhm... why? Well, people believed that they were valuable. They were trading in... tulips. Of course people here... went bankrupt. And therefore from February 9th to May 1st there were no prices at all on tulips. You could not sell a single tulip in all Amsterdam.

The rumours that created this tulip mania were not really information. It was... it was talk about a future where the red tulip, and the tulip general... they all had names like... generals or admirals typically... to create value. Of course... without financial instruments we can see that the speed of this trading... prices were increasing very quickly... Just a couple of months. And then the drop was also very quick. But...

Next slide: "Stock Market Crash of 1987"

...here's a picture of another instance where there were no very good models either. This is the stock market crash of 1987.

I have a personal memory from this day. It was a Monday. October 19th and I came into... I was attending the Stockholm School of Economics... and at that time of course... the school was in the forefront of technology... it had one stock market monitor mounted at the end of the corridor, so we could all watch it... and there was a line out up in the street... everybody was wondering how could this happen: In one day the New York Stock Exchange lost 23% of its value. Twenty-three... one quarter of the value of American companies was lost...

Very traumatic for the people who worked there... they were almost only people... there were no computers at the time. This is how they looked like:

Next slide: an image of shouting stock brokers

...they were all men too... or boys, maybe...

Was it real value that was disappearing that day?... was the question. The companies were still functioning. Nothing really happened after that. Stock market-wise it started to climb up again. The trauma in everyone involved was still there, but...

Both of these bubbles shared one characteristic: The instrument used to calculate value was very crude. Back in 1987 price was decided from looking at the price of other assets, other companies. But the actors did not work with any instrument that could tell them in detail how come the stock market was valued at any specific price...

Back to previous slide: “Stock Market Price of 1987”

...so they started asking questions about this. And adopted a model that was called the Cash Flow Model. And the Cash Flow Model acted as a stabilizer... for stock market valuation.

It's an ingenious piece of invention. It's one of the... I'd say one of the very great inventions of last century. It connects several events that happen in a company with the value. And it does so in detail.

Everybody can now see the stocks and the companies in the same way. They can understand the value-creation. They can enable everyone to talk about it. So in the end this model creates values that we can see in the stock market.

By using these models the analysts quickly recovered from a crash that was potentially lethal for them... because they had promised everyone that... don't worry... we know that your company... the one you buy now is worth that much.

Next slide: “Value Driver of the Cash Flow Model”

Here they started to explain it differently. They said... that any given value-creation is the result of connections all over the company life. They actually connected anything that happens in a company with the stock market price...

Next slide: “Connections of the Cash Flow Model”

So what we see here, is a company that is created with many strong connections to things that lie outside the stock market. These things are real. It's all in Swedish here... but it says... 'consumption in Germany'... that's very important... to understand the future value creation. It says... 'cost of personnel'... It says... 'cost of paper pulp'... It says... 'taxes in France'...

...so this Cash Flow Model did what no one else had done before. It connected the value of the company to real events outside the stock market. And these connections are very important for understanding the power of the model. The more and the stronger connections, the stronger the model.

It also affected how companies were managed. At first the model stabilized the stock market through educating the managers, telling them what is really important when you want to create value. Before... 1986... when one of the articles appears... before 1990 when the book of valuation came out... any manager could have their own say of what created value... Well, after the model they had to adjust to one standard. So this model really became performative. And the reason, again: it is the centre of strong and many connections.

So if I may quote an author on this... MacKenzie... he actually talked about option pricing models, but he said... 'rather than simply describing a preexisting empirical state of affairs, it altered the world, in general it altered the world in a way that made itself more true'.

So... so much for stability. And stability is sometimes difficult to see when we look at the world around us. Because what it means is that today's world looks pretty much like yesterday. But there's a darker side to these models. They can take on a life of their own. And they will find allies among the humans. So now, we are greatly dependent on these models. Their actions influence us and this is visible when we look at the events that disturb this stability.

There's another model that I will discuss here...

Next slide: “Black & Scholes – Assumptions of Volatility”

...I think it's beautiful!

It's the Black & Scholes Model. It was suggested in 1973. And it is one of those models that single-handedly has created a whole market. It's about option valuation. It looks very complex... and I think it is very difficult to understand in detail... we of course... teach people how to do that... but I will be content to just look upon it from the perspective: how does it affect the way we act?

Now there are almost no numbers in here, so we have to fill in the numbers. And I will spend a few minutes explaining what is stable in this model... and what will create mayhem if allowed to act independently.

First of all, it's an option pricing model. So an option is: I purchase the right... to buy a share maybe in three months. Now the share is in 70. I want to buy it in... 80 three months from now. So for that I will pay a price. And this model will calculate that price. Will calculate how much is it worth for me to have an option to buy that share for 80 in three months. So first of all we have the underlying price... that is, if the share today costs 70, that is the underlying price... we know that. We can look it up in tables. Every single second we have the underlying price. So this is a very strong connection to an underlying price that is not problematic to find out. Just keep that in mind. Not problematic. And then we have the strike price: How much am I willing to buy it for in three months. I said 80... it's part of the contract. So this is also non-problematic... it's very well connected to our contract and to hundreds of other contracts. And third... we have the time to maturity. Time to maturity shows up everywhere in the model, but it is very simple to calculate... I wanted three months, I will get three months. That's also in the contract. So, while this looks very complicated, we can see that most of these numbers are quite easy to put in the model. However, there is one... small piece of this model that makes it very very powerful. And that's the volatility.

Volatility is how stock markets... how the underlying share... how it moves... it goes from 75, 78, down to 68... up and down all the time. And that is very difficult to calculate. Because we are talking about the future volatility, so how many of us can say: how much is this share going to move in the next three months? If we knew that, we would know the exact price of the option. But we don't...

We don't even know the historical volatility. For how long period of time should we choose to decide the volatility? We don't know... three months? Five years? ... We're going to buy an option in Ericsson, they've existed for over 100 years on the stock exchange. Are we going to take all those 100 years into account? Should we perhaps weight it so that the last five years become more important than the first 95? Lots of models regarding that... but the real disagreement is because this is the future.

So we have a model that is very powerful. It's connected to the share price, it's connected to the future price and it's very much connected to the time period... say the next three months... this is going to influence something.

Say we have 1000 people that are interested in this and one model. So we have 1001 actors. Which single one of these actors is going to be the most powerful when it comes to deciding the price... of Ericsson in three months? I would argue that it might very well be this model... the single most powerful actor. And it has an air of respectability around it. It was presented, as I said, in 1973. It's tested with academic rigour. Everyone involved in the creation of this has received the Nobel Prize.

If you bring in academics here... financial academics... of which I'm not one unfortunately... they will show how solid this model is. And so we believe in it. We make it very strong. But also... when we let it out... it becomes very difficult to control. It's like when they let out these small... rabbits... in Australia... you know they started to make a life of their own... it's the same in Kungsholmen here in Stockholm.

So the option model will affect things. And it will create a world that fits this model.

Take the recent collapse of the HQ Bank. They found out in June that they had seriously miss-valued their options. They lost over one billion Swedish kronor on that. And why? Well, see, I'm sure several of you have figured this out... if you set this volatility... to very high, the option price will be very... very high. So the option will be valued higher, the more volatility we expect in the future.

What they did at HQ was saying that... Well, I will make my own assumptions about volatility. And so powerful was this model that no one really dared to question it. No one questioned those assumptions. And so we can see that this model is indeed very performative. It actually brought down a bank. How many here have brought down a bank?

We think, as humans, that we would have control over the models that we create. I say that's perhaps not the case. If anything is controlling and checking these models, it is their connections with other entities. With these connections they will still influence our world, but their influence might be predictable and stable.

So the latent power of these models really becomes visible in the event when they start acting out new connections that they themselves create. And their power becomes visible because the destruction is so easy to see.

These instruments are performing our world... They form our world. They form our conception of the world. And they also co-create the world. They make their own living models more true.

So in the quest for knowledge, our creations will sometimes help us and sometimes they will turn on us. And the more powerful we make them, the more powerful they'll be... that's how it is.

Audience applause.

Simon and Jakob stand and applaud walking towards Peter to thank him and shake his hand.

Simon: Thank you Peter. Thank you.

So ... from models to the real thing ...

You may have questions for Peter or for either of us ... and we'll be happy to answer them at the end when we hope you'll stay around for drinks and to talk. But as Jakob said before, we still have something very special to show you.

So right now we're going to ask you to follow us directly to the lobby area where we're going to spend the final formal part of the evening ... another ten minutes or so.

So please ... if you'd like to take your belongings and please follow us ...

Financial Instruments Performativity on the Financial Markaets

The Great Tulip Mania in 1637

Stock market crash of 1987: S&P500 Stock Index

Valuedriver of the Cash Flow Model

Connections of the cash-flow model

Black & Scholes - Assumptions of Volatility

$$C(S, t) = SN(d_1) - Ke^{-r(T-t)}N(d_2)$$

$$d_1 = \frac{\ln(\frac{S}{K}) + (r + \frac{\sigma^2}{2})(T-t)}{\sigma\sqrt{T-t}}$$

$$d_2 = d_1 - \sigma\sqrt{T-t}$$

fig. 1.1.1 – 1.1.7
Power Point slides from Peter Hägglund's lecture



fig. 1.1.10
Entrance, IFL Executive Education



fig. 1.1.8
Simon and Jakob introducing Peter Hägglund



fig. 1.1.11
Simon and Jakob introducing August Nordenskiöld's alchemy oven



fig. 1.1.9
Peter Hägglund lecturing



fig. 1.1.12
Simon and Jakob unveiling August Nordenskiöld's alchemy oven

Now in the lobby, Simon and Jakob are standing at microphones. Next to them something ... a cabinet ... is concealed beneath a red velvet cloth.

Simon and Jakob watch the audience gather round them, nodding and smiling.

Simon taps the microphone, coughs, and speaks into it.

Simon: Can everyone see ok? Good. So ... Hello again. Welcome to the lobby.

Jakob taps his mic, coughs, and speaks into it.

Jakob: Hello. And welcome back to 'The Nordenskiöld Model' by Goldin+Senneby; Act 1, Scene 1 ... '300 Years of Speculative Realities'.

Simon: Jakob and I have been speculating on the nature of speculation ... financial speculation that is. And we've been searching for a way, as artists, we can make our speculation manifest so that it can be seen ... really be seen in public. We've been looking for a way of turning it into an event ... or series of events ... where people can come together and watch ...

And so we've been speculating as to how we might make theatre ... real theatre from our speculation ...

Jakob: And we have something to show you ...

Simon: Yes, but before we do ...

Jakob: Yes, before we do ...

... yes, we thought it was interesting that in 2000, the Swedish and Danish governments commissioned a famous British playwright to write a play for the inauguration of the Öresund bridge.

Sadly, we don't have the resources of the Swedish and Danish governments ... but never mind ... we've commissioned a less well-known British playwright to write a very short play for this inaugural event.

Simon: (unfolding a letter) This was the playwright's response to our invitation ... her name is Pamela Carter ... she said 'I'm honoured and excited. Thank you. I am a huge admirer of Howard Barker's work' ... that's the famous British playwright ... 'and as I understand it, his play for the opening of the Öresund bridge provoked civil unrest.

But this inauspicious beginning has had absolutely no impact on the success of the bridge I think ... either economically or symbolically. As well as wishing 'The Nordenskiöld Model' similar success for the future I can also assure you I don't want to upset anyone.'

Jakob: And in this spirit, Carter has written a 'monologue' for us ... a monologue to be performed by a girl of ten years of age.

Carter suggested the girl be Finnish like Nordenskiöld himself. Or be of African descent, from Sierra Leone.

Simon: Carter wrote 'the child doesn't just represent hope, the future ... she physically embodies these ideas. She is, we can assume, at the beginning of her journey, and I can't think that even the most cynical of people wouldn't want a long and fruitful one for her. And standing as she will, in a place of adult education, she is also a mirror in which the audience, embarking on their own journeys, will see themselves reflected.'

Jakob: However ... we felt this proposal was problematic for a number of reasons ... where would we find the right child? Would we have enough time to develop a good working relationship with the child? Could we be confident that she would master such a performance being so young?

Simon: And we thought it might be too cute as well. Kind of annoying.

Jakob: So instead we decided to read the script to you ourselves. Or rather, Simon and I tossed a coin ... and decided that Simon would read the part of the girl to you. Please imagine that it's this girl speaking here to you today and not Simon. It's ok if you want to close your eyes ... if that makes it easier ...

Simon: (to Jakob) Thanks.

Simon and Jakob both read from scripts held in their hands.

Jakob: Here it is. Our inaugural play ...

'300 Years of Speculative Realities' by Pamela Carter.

Jakob looks at Simon as he reads the following stage directions.

'The lights dim leaving a spotlight on one microphone only ... the one closest to the curtained cabinet.

A young black girl enters stage left and approaches the microphone. She wears skinny jeans, hi-tops, a big pink jumper.

Simon and Jakob adjust the microphone to her height, the girl takes her place at it and they draw back into the darkness. There is applause.'

Simon: 'Hello. My name is Augusta. I'm very happy to be asked to give a speech to celebrate the inauguration of Simon and Jakob's work of art here.

Peter has already given a speech about models.

My speech is about magic ... the kind of magic that is about making things happen.

This is an oven ...'

Jakob: 'Augusta pulls a cord and the velvet cloth falls to the floor to reveal a transparent vitrine containing an eighteenth century coal burning oven.

The oven is beautifully illuminated. It glows almost. There are gasps from the audience and a ripple of applause.'

Simon. Simon.

Jakob points to the cabinet.

Simon: Oh sorry.

Simon pulls the cloth from the vitrine to reveal the oven.

Jakob: 'Augusta smiles and continues.'

Simon: 'This is an oven. It's a real oven and it actually belonged to August Nordenskiöld, who was an alchemist, who worked in secret for King Gustav the third, in this city, in the 1780s.

The oven has been leant to us by the Nordic Museum.

Alchemy is a kind of magic but also a kind of science, and alchemists were scientists and philosophers.

Nordenskiöld was looking for the philosopher's stone, which alchemists believed would allow them to transform base metals into pure gold.

The king of Sweden employed Nordenskiöld to make gold for him because he needed the money to wage war against Russia. But

Nordenskiöld had another idea. He wanted to find the philosopher's stone not to make money for material gain or for war but because he had a spiritual purpose. He wanted to make so much gold that the market would be flooded with it. Then all men and women would be freed from the tyranny of money, and a new society would be created that was based on love and work.

Now I'm going to tell you how the oven works ...

Firstly, you need gold ... Nordenskiöld said it was logical that the philosopher's stone had to be made out of gold in the first place ... so the gold goes in here ...

Simon points to the relevant parts of the oven as he describes them.

'Then you have to heat the gold by burning coal here ... this is the most difficult and mysterious part because you have to keep the oven burning constantly for a very long time. Nordenskiöld said that knowledge of this process could only be obtained by great experience.

Then you have to heat the gold so it changes colour. It should go in a regular cycle of colours ... red, then black and then white, and with colours in between. And this cycle has to be gone through 3 times. The first cycle takes 9 to 12 months, the second takes 3 months, and the third one, one month.

You can keep on going if you want to but you have to add fresh gold after each new cycle.

And that's how you make a philosopher's stone.

Of course, Nordenskiöld didn't really learn how to make gold from base metals. But he really believed he would, and he really did try to make it happen with this oven here.

I'm ten years old, and maybe ten is too old to believe in magic. I know that when the magician pulls a rabbit out of the hat, that it was always there to begin with. But I love how the magician can make you want to believe it wasn't. And I know a real rabbit when I see one.

I believe that if you want something enough, and enough people believe in it then anything can happen.

I wanted to try to make gold for you ... to give to you as a present. But I wasn't allowed to use this oven because it's very fragile and of

historical importance. And I only have an ordinary oven at home. So instead of gold I baked you these magic biscuits to say thank you, and to wish you good fortune for the future.'

Jakob: 'Augusta turns and takes a tray from Simon.

She steps off the stage and moves through the audience inviting them to take a biscuit from her tray as she does so. They are ginger biscuits. Delicate round discs, each decorated with a small piece of gold leaf.

The biscuits are delicious. The audience murmur with pleasure as they eat them.

Simon shrugs apologetically to the audience.

'When all the biscuits have been distributed, Augusta returns to the microphone.'

Simon ...

Simon: Sorry.

'In 1792 Nordenskiöld decided to build a utopian society in Africa. So he travelled to Sierra Leone, which is where I'm from. Unfortunately, this perfect society was never built in Sierra Leone because Nordenskiöld died there before he had time.

That's the end of my speech. Thank you very much.'

Jakob: 'Augusta curtseys ...'

Jakob looks expectantly at Simon, Simon shakes his head and mouths something that might be a silent 'fuck off' to Jakob.

Jakob: 'Augusta curtseys. Simon and Jakob and Peter join her on stage.'

Simon: Thank you very much Augusta.

And thank you all. Nordenskiöld's oven ... and it really is his oven ... will be here for the next five weeks. Please come and have a closer look at it.

Jakob: And please join us for Scene 2, 'A History of Micro-Second Trading' which we'll be staging on November 23rd.

Thank you again to Peter and the institute. Please stay and join us for a drink ... and hopefully see you again.

A STORY OF MICRO-SECOND TRADING IN TWENTY MINUTES

Pamela Carter

Eva: Dear Simon and Jakob,

Dear people on the bus,

Dear Eva,

People-on-the-bus ... this is Eva speaking ... but her words are written by me ... Pamela Carter ... the playwright commissioned to write this scene ... Scene 2 ... of 'The Nordenskiöld Model'.

Simon and Jakob, I'm finding this difficult as you know ... writing Scene 2. And you've asked me to articulate my position more clearly in order to move things along. I'll give it a go.

I'm behind on a play I should have finished by September just passed. It starts rehearsal in January. The play's called 'Wildlife'. So my 'position' currently is a sort of undecided 'fight or flight' stance. I run. I stand and write. Either way it's going to hurt.

But, it's nice to think of you all together on the bus this evening. I'm sorry I'm not there. Think of me at home in London, at my desk, wrestling with 'Wildlife'. That's what I'll be doing this minute, I guarantee. It's a lonely business.

Eva, I'm sorry not to be able to meet you in person. I hear you are currently working at Stadsteatern, rehearsing a play called 'Enron' by Lucy Prebble. A play about the financial collapse of the American company 'Enron'. This is great. And rather irritating. I've been researching and writing about finance for the last two years almost and this play's success has followed me everywhere. I'm not even spared in Sweden it would seem.

'Why didn't you write a blockbuster account of corporate fraud?' I'm asked. 'Why do you fucking think?' I think.

Anyway. Never mind. No matter. Here I am. There you are.

Have we started moving yet? Are we on our way?

One of the reasons I'm finding this ... 'The Nordenskiöld Model' ...

so tricky is the process. Usually I'd spend months trying to feel my way through to pieces of dialogue and then characters and scenes. Then there'd be drafts and re-drafts, readings with actors, notes, re-thinks. And some time, quite far down the line, all things being well, there'd be a show. And an audience ... hopefully.

But this process ... your schedules, Simon and Jakob ... there's an audience almost from the beginning. Hello everyone.

There's a subject matter, for sure. And there are some faint voices sounding in my head ... but who they really are, what they want from each other, and what they might say to each other ... I haven't a clue. Theatre needs people ... characters ...

Maybe it's useful to recap ... who we've got so far.

There were two characters in Scene 1 ... 'Peter Hägglund', CEO of the business school and expert in 'business models'. And 'Augusta', a ten year old émigré from Sierra Leone.

(Thank you for the pictures from Scene 1 by the way. 'Peter' was very handsome, wasn't he?)

'Peter' and 'Augusta' both gave speeches but there was no dialogue between them.

I often start with a monologue for a character ... to find out what they might say to themselves ... but these never actually appear in my plays ... they're just writing exercises.

Now where are we?

So I was commissioned to write Scene 2 - the scene is called 'A Story of Micro-Second Trading in Twenty Minutes'. And this scene takes place on a bus travelling ... travelling where? 'To the very centre of the stock exchange' your flyer says.

Trying to get to the centre of things, the heart of the matter ... it's never quite where you think it's going to be. In my experience anyway.

My hands are cold. It's cold here today. Are you warm enough ... on your bus?

Right now if you touch the person next to you and you're warmer than

he or she is ... well then, maybe this warmth will move from you to them ... if the condition of the bus is warmer than both of you, that is ... a cold bus and you'll move coldness ...

Heat is energy, and temperature is what causes it to move.

Someone told me it's like money, it has no value unless it's moving. This is what is meant by 'liquidity' ... when people stop buying and selling, then there's no liquidity. And that's when stock markets crash ... when everyone stops buying and selling. Which is about belief ... I believe. People stop believing in a stock ... or the market ...

Right now, Ireland is having a tough time being credible. An entire country is having problems with plausibility.

Ireland needs the world to believe it won't default on its huge debts. This is so it'll be able to borrow more money in the near future. Ireland says everything will be fine.

Did you know the Irish government has used EU funding to buy a vast amount of cheese which it's distributing free of charge to its struggling citizens?

I've looked at the press coverage. There has been 'anger', 'outrage', and 'disbelief'.

It's a lesson in story telling ... 'cheese' is not serious. 'Cheese' does not inspire confidence. 'Cheese' is 'unbelievable'.

Theatre is about believability also ... and I don't mean how close it looks to real-life ... I mean, I can see it's not real ... but I still want to feel something anyway. I need to believe it is trying to be truthful about something. About the world we live in.

Is it dark outside? Is there much to see? This is a guided tour after all.

The human brain takes about 200 milliseconds just to understand simple visual stimuli, you know. It takes another 200 milliseconds to command muscles to react. And then there's the time it takes to perform the reaction itself.

We're quite slow creatures ... humans.

In physical comedy, it's a rule that you slow the action down ... just a little ... just enough to give the audience time to see the joke fully ... and then laugh. This is what Laurel and Hardy knew. Check it out

next time you see one of their films.

We have evolved, slowly, over hundreds of thousands of years in a slow world. But today we've succeeded in creating a world that goes really really fast.

Where we're going ... on this bus, I mean ... the heart of the stock exchange ... there are computers making trades at sub-millisecond speeds. They send messages a million per second at sub-250 micro-second speeds.

A micro-second is one thousandth of a millisecond, by the way.

200 milliseconds for a human being to understand a simple visual stimulus ... less than one millisecond for a computer to make a trade.

This is a problem I'm having with writing a play about this business. It's just not on a human scale. Mathematics, algorithms, computers, numbers ... it's hard to find the human story in it.

But it's nice to know you guys are there. Together. On your way somewhere to ... to do what exactly? To look at what?

If it were 1989 and we were on our way to the stock exchange then we'd be heading to the trading floor of the exchange building in Gamla Stan.

And we'd get there and head to the pit to see people, mostly men, shouting, waving pieces of paper ... it'd be loud and busy and physical.

We'd see anxiety, exhilaration, sweat and spit ... traders reading each others faces for information, forming alliances ... having fights ... we'd feel the cortisol, testosterone, adrenalin ... we'd think about people's haircuts, their suits.

Trading in Stockholm was computerised in 1990 though.

So today we're on our way to the current exchange ... Nasdaq OMX Stockholm ... that's where the action is.

Well actually ... what we're on our way to see isn't the Nasdaq OMX building as such ... where the traders are, where real people work in real offices ... no, that's in Frihamnen. There's a bus service every weekday from Karlapan for Nasdaq employees if you want to catch that one sometime ...

Is my twenty minutes up yet? You must be there almost and we haven't done micro-second trading.

Eva. You'll know from your work on 'Enron' that turning complex financial information into theatre is tricky. The director of the original London production tackled this issue by choreographing song and dance routines ... by making a spectacle of the story ...

So Eva, if at any point during the following explanation of micro-second trading you feel that I'm losing the audience ... please feel free to make any interpretive asides or gestural improvisations you think appropriate to keep them entertained.

Ok. Micro-second trading. Here we go.

Oh but to understand micro-second trading I think you need an idea of what 'arbitrage' is, first.

Ok. Arbitrage. Let's say I'm a trader ... and it's easier if I think about a tangible product for the moment ... so let's say I'm a trader and I notice that pork bellies are selling at one price in one market and are being bought for a higher price in another.

I put the two together ... I connect the seller and the buyer ... they both get what they want ... and I get to keep the difference between the two prices ... this is arbitrage ...

And this works with intangible products also ... financial instruments, debts, indices ... products that only exist in computers as transactions moving through them.

Now the opportunity for profit, the time period when arbitrage might be possible is limited ... because it's not long before one market hears what's happening in the other and the prices even out and my services aren't needed anymore. It's hours, minutes maybe ...

Or acting in computer-time ... then maybe it's milliseconds ... or micro-seconds ... time periods so small that they don't exist in any meaningful sense to a human being ...

But a computer generated algorithm, processing huge quantities of data, working through powerful computers with super-fast connections ... these algorithms don't just see gaps for arbitrage, they make gaps for arbitrage.

So this is micro-second trading ... computer generated algorithms that can analyse market data and execute rapid trades in huge quantities ... with little to no human intervention. In fact there are 100% robotic-trading algorithms which select stock, manage portfolios and execute trades with no human intervention whatsoever.

Are we at the industrial park yet?

Remember I mentioned 'a million messages per second at sub-250 microsecond speeds'? Well, that's what the Nasdaq trading platform does. and that's why we're going to the Lunda industrial park ... it's where Nasdaq keeps its computers in what's called a 'data centre'.

May 6 this year and there's something called 'the Flash Crash'. May 6 at 2.42 pm, the Dow Jones Index plunges losing 600 points in five minutes. There is horror in the financial world. Panic. And then over the next 20 minutes the index gains most of those 600 points back.

A few months later, and the financial authorities issue a report suggesting this 'flash crash' might have been caused by algorithmic trading and micro-second trading in particular.

But really? They can't say for sure. And that's because they can't actually know because it's impossible to know ... it's impossible to take that five minutes of trading and break it down into chunks of time small enough to make the data readable. The speed and volume of the trades are too high to capture and analyse.

The world of finance is all speed and connectivity and intangibility. I heard an economist say that 'this will always lead to blur. The world is more fragile and more reliable and predictable. We all just have to get used to the blur.'

'Fragility', 'predictability' ... 'getting used to the blur'.

These ideas are interesting to me ... they are human.

Are you there now? You must be close. Close to the Nasdaq OMX data centre where the computers and hubs and servers of the stock exchange are kept.

In 2009, this exchange generated 2.3 trillion euro.

A trillion. Does that mean anything to you? Neuro-psychologists think humans can only understand numbers they deal with in the

everyday. Adults ... we can think a 'million' no problem. But to most people a billion is 'a few million' ... and a trillion? It's maybe just a bit more than a billion.

If that's what you do ... and I did ... then try this.

Count to a million ... in seconds ... one, two, three ... to a million ... non-stop, of course. That would take you about 11 and a half days.

Count to a billion ... it'd take you just under 32 years.

And count to a trillion ... that would take you 31 thousand, seven hundred and ten years ... or thereabouts ...

I hope that's useful. So where were we ... yes ...

Last year, this exchange generated 2.3 trillion euro.

Remember a million is 11 and a half days, a trillion almost 32 thousand years.

2.3 trillion euro.

Imagine if something went wrong here.

But nothing will go wrong because the centre is safe and secure. That's what this centre does. Safety. Security.

The computers are safe, of course they are. All that processing power consumes a lot of energy ... which generates a lot of heat ... which, like money, needs to be kept moving. But there's no touching. So air conditioning moves the heat away so the computers don't lose efficiency ... or catch fire.

And keeping them running there'll be two separate lines of power into the site. And in the unlikely event both of them are cut, there'll be back up battery power and diesel generators.

And there's security. Physical security ... fences to keep intruders out, walls that'll withstand heavy impacts ... and administrative security ... guards to patrol, retina scanners to check identity.

It's all about reliability and predictability here.

You do realise that there's no way we're going to get any closer than the perimeter fence, don't you?

But I feel a bit of a fraud getting you out here to show you this. An

ugly building. At a distance. In the dark.

But something could happen here ...something should happen here ...

So let's try this for a scene ... or the beginnings of a scene ...

Eva should get off the bus. Yes, I'll imagine Eva getting off the bus. And you? ... you can follow her and watch to see what happens if you like ...

A sketch for Scene 2.

'A wire fence, evening.

A group of around 50 people stand on one side of the fence. Men and women, mostly in their 30s and 40s, dressed for winter. They sip from cups of warm punch, stare through the fence at whatever lies on the other side.

A security guard approaches on the other side of the fence. He asks someone from the group to explain what they're doing there. A woman, 'Eva,' steps forward. She says she's an actor ... she says, in fact, they are all actors. And they're doing some research into financial institutions ... to help them with a theatre play they're rehearsing. It's a big cast. Look, there are the directors Goldin and Senneby.

Eva says they realise they've come to the wrong Nasdaq building and they should've gone to the one in Frihamnen. There's nothing to see here.

The security guard says he doesn't know anything about Frihamnen but confirms that there's nothing to see here. Eva offers the guard some punch and asks if he minds if they ask him some questions ... to help with their research.

The group moves closer to the fence to hear what the guard has to say ...

Here is the end of my 'letter' for when everyone is back on the bus ...

So that's an idea for Scene 2. Or the beginnings of one.

I'm really not sure who the security guard is yet ... what his circumstances might be ... what he might want in this scene ... what his position might be in relation to 'The Nordenskiöld Model' as a whole.

So maybe you can think about these things and get back to me with some suggestions.

But that's me done for this scene I think ... I hope.

Again, I'm sorry I'm not there. But thank you people-on-the-bus, and thank you Eva. If you have any thoughts or questions then I'd be grateful if you could let Simon and Jakob know and they can pass them on to me.

Goodbye for now and a safe journey home to you all.

My best wishes,

Pamela.

EPILOGUE

Simon: Thanks a lot Eva! And thank you also Pamela! It does give you something to think about, right? So for the trip back; in the first scene "300 Years of Speculative Realities"... I think some of you were there... I see some familiar faces... Augusta, the girl from Sierra Leone, served you some biscuits, ginger biscuits with a golden leaf...

Jakob: Imaginary biscuits, Simon. Imaginary.

Simon: Yes, that's right. Imaginary biscuits. Now to the real thing. Today we want to serve you some cheese. Irish cheddar that is. In the meantime we will listen to a selected soundtrack. So just relax and enjoy.

Simon and Jakob serve Irish cheddar with crackers and grapes to the people on the bus. The following selection of music is played: 01 Threepenny Opera Overture; 02 Money, Money (Liza Minnelli & Joel Grey); 03 Too Darn Hot (Ella Fitzgerald); 04 Those Enron Boys (Paul & Storm); 05 On the SS Enron (Eskit); 06 If I Were A Rich Man (Fiddler on the Roof); 07 Fly Me to the Moon (Frank Sinatra).

Jakob: Thanks for joining us today. We are now back at the institute. And here at the institute the third and last part will occur on December 3rd at 6 pm. "Plan for a Speculation". Please join us then. Thank you.



fig. 1.2.5
Eva Rexed reading letter by Pamela Carter



fig. 1.2.1
Seen through the window



fig. 1.2.4
On the bus



fig. 1.2.3
The bus stops outside the fence



fig. 1.2.6
Handing out Irish cheddar

PLAN FOR A SPECULATION

Pamela Carter

A table and four chairs.

Actor 1 enters and walks centre-stage to address the audience. He is wearing a merchandising t-shirt from a play ... a play by Shakespeare ... 'Macbeth' maybe.

Actor 2 enters behind him carrying a box which he sets down on the table. Actor 2 is also wearing a merchandising t-shirt, this time from a large-scale commercial musical ... maybe 'Miss Saigon' or 'The Lion King'.

Both actors are referring to or reading from printed scripts ... the cover says 'Plan for a Speculation'.

As actor 1 talks, actor 2 unpacks the box, which folds out into a model of a theatre stage.

Actor 1: Hello everyone and welcome to Act 1, Scene 3 of 'The Nordenskiöld Model'. Or really, what I should say is ...welcome everyone to a kind of rehearsal ... or rough sketch ... of Scene 3 of Act 1 of 'The Nordenskiöld Model'.

This is the final scene in the act, and it's titled - 'Plan for a Speculation'.

And for those of you who saw Scene 1 or Scene 2 ... or both even ... you'll recognise me ... I hope ... and '____*' here (actor 2 nods to the audience) ... my name's '____*', by the way.

'____*' and I, we've been playing the roles of the two artists 'Simon Goldin' and 'Jakob Senneby' ... I'm 'Simon' and this is 'Jakob'.

(to actor 2) Are you ready?

Actor 2 nods.

Actor 2: Hi everyone. Good evening.

So originally, the writer saw this scene taking place in a theatre ... but as you can see we're back here at the institute for business management.

However, as we are actually talking about theatre, we thought it would be nice to have something real to refer to ...

So here we have a real scale model of a theatre stage. In fact, it's actually a model of the main stage at Dramaten here in Stockholm.

As actor 2 speaks, actor 1 is arranging models of a table and four chairs on the model stage.

And in the stage directions for Scene 3, the writer stipulates there should be four chairs on stage.

(indicating the model) Here are the four chairs. But as you can see, we've also added a table ... to put the model on ...

Actor 1 hands actor 2 a mug.

Thank you.

The writer also gives us props. She says there are four mugs.

Actor 1 has put two mugs on the table and is holding one.

I think what she's trying to do here is communicate intimacy ... informality ...

Actor 1: And expectation. She's setting up an expectation ... of more people to come.

Actor 2: Yes.

Actor 1: Of two more people to come.

Actor 2: Yes. But before they do ... we thought it would be useful to look back at where we've been so far ... a quick recap on scenes 1 and 2.

Actor 1: Sure. Because we realise that maybe not all of you have seen them. And because it's useful for us ... as actors ... trying to better understand our characters and the world they inhabit.

So Scene 1 ... and "____*" will set up Scene 1 for you ... sort of ... so Scene 1 was '300 Years of Speculative Realities' and took place here.

Two characters, 'Simon' and 'Jakob', artists who work together as 'Goldin + Senneby' ... they introduced themselves, welcomed their audience to their project 'The Nordenskiöld Model' and introduced two other characters ... 'Peter Hägglund' ... the CEO of the business school ... and 'Augusta' a ten year old refugee from Sierra Leone.

'Peter' gave a talk about financial models ... about how they make financial realities rather than just describe them.

And 'Augusta' gave a speech about magic and unveiled an eighteenth century oven ... the oven belonging to August Nordenskiöld ... the namesake of this project.

(indicating the model) So here's our little model of the oven. (pointing across the room) Although the real oven is over there, of course.

(pointing to a figure in the model box, to actor 2) Is that Augusta?

But really, when we staged Scene 1, the role of 'Augusta' was read by 'Simon' ... who is played by me. so I was 'Augusta' ...

So that was Scene 1.

Actor 2 stands back to show the model box and then strikes the set to prepare the next scene.

And then Scene 2, called 'A Story of Micro-Second Trading in Twenty Minutes' was staged eleven days after Scene 1 on a bus travelling from here to the Lunda industrial park ... the location of the Nasdaq OMX data centre.

The actress Eva Rexed played herself ... and there she is ...

(Indicating a woman in the audience. The woman waves.)

Hi Eva. And Eva read a letter from the writer Pamela Carter, in which Pamela talked about the difficulties of understanding and explaining and writing about micro-second trading.

When the bus finally arrived at the data centre, everyone got off the bus to look ... (indicating the model) and here we are, looking ... we all got off the bus to look at ... well, not much really.

Actor 2: Except for the man I saw ... behind the fence.

Actor 1: What man?

Actor 2: The man with no trousers ...

Actor 1: I didn't see him.

Actor 2: Just in his underwear ... maybe he was a guard off-duty ...

Actor 1: It was very cold ...

Actor 2: Yes ... he was brave I thought. Look, I'll put him here.

He puts in a figure into the model behind the fence.

Actor 1: And so, it was cold but there was hot punch. And then we got back on the bus and then there was cheese.

And that was Scene 2. 'A Story of Micro-Second Trading in Twenty Minutes.'

And now ...ten days on ... and here we are ... it's Scene 3. This is it. We have a title ... 'Plan for a Speculation' ... and what we're wondering is 'what happens now?'

Actor 2: Usually, in a play ... with a script ... that's quite easy to answer ... you know, you just turn the page over and it says 'so-and-so says to so-and-so ... and then this happens ... and that ... and so on and so on ...' and even without a script, when you have a writer on the project... as we have ... this 'Pamela Carter' ... then it's the writer's job to answer the question 'what happens next?' ... or give us some idea, at least ...

So last week, we spoke to Pamela ... the three of us ... we spoke via Skype ...

We talked about the themes so far ... finance, of course, but also power ... and visibility ... and technology ... and biscuits ...

Actor 1: And we talked about what kind of theatre we might be making ... how does it describe the world we live in? Is it optimistic about human nature?

Actor 2: And is there a genre? Is this naturalism? Or might 'The Nordenskiöld Model' turn out to be musical theatre? ... you know ... will there be singing and dancing?

Actor 1: And we talked about our characters ... as actors we need to find out who they are so we can inhabit them as fully as possible...

Actor 2: Yes, we need to know what they want, what makes them tick ... even if we don't know yet what's going to happen to them.

Actor 1: Because by the end of Act 1, we should have an idea of a narrative unfolding ... a story which will drive us forward into Act 2 and beyond.

So we chatted for a while, the three of us, about the possibilities ...

and it was fun speculating ...

Actor 2: But eventually Pamela said that actually, it wasn't her we should really be talking to. She said that it would be more useful talking directly to Simon and Jakob ... the real Simon and Jakob ... it is, after all, their project ... and besides, this plan ... they have a plan, if not the plan ... the one mentioned in the title of the scene. She said maybe they have the answers ... talk to Simon and Jakob ...

Actor 1: And that's exactly what we're going to do. So ladies and gentleman, we'd like to welcome to the stage Simon Goldin and Jakob Senneby ...

Simon and Jakob enter. Simon is holding a copy of 'Plan for a Speculation'. The four shake hands, the actors hand Simon and Jakob a mug each. They sit.

*Insert names of actors.

END-OF-THE-WORLD TRADE

Donald MacKenzie

Last November, I spent several days in the skyscrapers of Canary Wharf, in banks' headquarters in the City and in the pale wood and glass of a hedge fund's St James's office trying to understand the credit crisis that had erupted over the previous four months. I became intrigued by an oddity that I came to think of as the end-of-the-world trade. The trade is the purchase of insurance against what would in effect be the failure of the modern capitalist system. It would take a cataclysm – around a third of the leading investment-grade corporations in Europe or half those in North America going bankrupt and defaulting on their debt – for the insurance to be paid out.

I asked one investment banker what might cause half of North America's top corporations to default. No ordinary economic recession or natural disaster short of an asteroid strike could do it: no hurricane, for example, and not even 'the big one', a catastrophic earthquake devastating California. All he could think of was 'a revolutionary Marxist government in Washington'. That's not a likely scenario, yet the cost of insuring against it had shot up ten-fold. Normally one can buy \$10 million of end-of-the-world insurance for between two and three thousand dollars a year. By early last November, the prices quoted were between twenty and thirty thousand, and even then it was difficult to buy in quantity – at least, said the banker, 'not from anyone you trusted'.

Of course, the credit crisis has increased the risk of systemic economic failure. But the existence and rising price of the end-of-the-world trade indicate something beyond that. The crisis isn't just about the bursting of the US housing bubble and dodgy sub-prime lending. Nor is it merely a reflection of the perennial cycle in which greed trumps fear to create a euphoric disregard of risk, only for fear to reassert itself as the risk becomes too great. What is revealed by the end-of-the-world trade is that the current crisis concerns the collapse of public fact.

A price or an interest rate quoted by one person or firm to another and agreed between them is a private fact. That isn't good enough for many purposes. Even purely bilateral transactions are facilitated if there is a public fact, in this example a known and credible 'market price' or 'market interest rate', that can be consulted to check whether a quoted price or rate is fair. Trustworthy public estimates of borrowers' creditworthiness make debt markets far more liquid than they would be if borrowers' capacity to meet their obligations had to be investigated from scratch. Believable bank balance sheets encourage banks to lend to each other; it was the suspension of such lending that undid Northern Rock. As the American sociologists Bruce Carruthers and Arthur Stinchcombe pointed out in the journal *Theory and Society* in 1999, market liquidity – plentiful borrowing and lending, or buying and selling – 'is, among other things, an issue in the sociology of knowledge'. Believable market prices, valuations, credit ratings and balance sheets encourage lending, active trading, competition and keen pricing. If credibility is lost, then everyone becomes wary of lending, deals aren't done, and an increased proportion of sellers are the desperate, who have to accept fire-sale prices.

At the core of the current crisis is a set of mechanisms for the transfer of credit risk (the

risk that borrowers default), in particular collateralised debt obligations (CDOs). The first CDOs were created in 1996-97 by banks that wished to pay others to take on the risks of the loans they had made. From 1999 onwards, CDOs were also pursued simply as money-making opportunities, and hedge funds as well as banks started to set them up.

CDOs come in many varieties, but one way for a bank or hedge fund to set one up is to create a separate legal entity known as a special purpose vehicle (typically registered in the Cayman Islands). The vehicle then buys assets such as corporate bonds, loans and bonds backed by mortgages, either from the parent bank – if, for example, the motive for the CDO is to reduce the risk of its loan portfolio – or on the open market.

To raise the money that's needed for these purchases and to create the opportunity for profit, the vehicle sells a hierarchically structured set of investments backed ('collateralised') by the pool of assets the CDO has bought. At the bottom of the hierarchy is the 'equity' tranche. Losses caused by default of the assets in the pool are absorbed in the first place by investors in this tranche, who in compensation receive the highest rates of return, often as high as 15-20 per cent. Next in the hierarchy is the mezzanine tranche or tranches, the investors in which incur a loss only if defaults are sufficiently bad to wipe out the equity tranche completely. Above the mezzanine is the senior tranche, and above that the super-senior. Because the buffer of the equity and mezzanine tranches stand between it and any losses, the senior tranche is usually regarded as very safe (equivalent to a corporate bond with the highest rating, AAA), and super-senior as even safer than that. Correspondingly, investors in these tranches have to accept rates of return substantially lower than those in the equity and mezzanine tranches.

For a structure as complicated as a CDO to be attractive to investors, facts about it need to be created: ratings, crucially, awarded to its tranches by firms such as Standard & Poor's, Moody's and Fitch. Traditionally, the core business of these rating agencies is to grade bonds issued by corporations. They divide these between 'investment-grade' and 'speculative' (colloquially, 'junk'), and there are multiple categories indicating how high in investment grade, or how low in speculative grade, a bond is. Standard & Poor's, for example, has ten categories of investment grade, ranging from AAA down to BBB-. Recently, however, a large part of what rating agencies have done is to grade CDO tranches. Many investment institutions are strongly guided by ratings, and some are allowed to invest only in investment-grade products. The success of CDOs has rested on the way they can be set so that the mezzanine and senior tranches can achieve investment-grade ratings while offering higher rates of return than equivalently rated corporate or government bonds.

To award a rating, or more generally to work out the value of a CDO, requires one to take three main things into account. First is the risk of default on each of the debt instruments in the asset pool. Past data are useful here – the rating agencies have kept records of corporate defaults for decades – and the market's current view of such risk can be worked out, either from the yield of the bond involved (a risky bond has to offer a higher yield before investors will buy it) or from the cost of credit default swaps. Like CDOs, these swaps are 'credit derivatives' – products built on the underlying market for bonds and loans – and they too have grown rapidly over the past decade. They are insurance, essentially, against the risk of an individual company defaulting. Under normal circumstances, credit default swaps are actively traded (far more often than a company's underlying bonds or loans), and thus have a credible market price.

A second issue is 'recovery rates': the amounts that creditors will get back when borrowers default. Though these rates vary, it's common in CDO valuation simply to

assume a recovery rate of 40 per cent. Third, one needs to take into account the extent to which defaults by different borrowers are likely to cluster. Some defaults are the result of idiosyncratic problems causing the bankruptcy of a single corporation, but others reflect systemic factors such as poor conditions in the economy as a whole. If the latter, then one corporation's default is likely to be accompanied by others.

The extent to which default risks are linked is known in the world of credit derivatives as 'correlation'. If correlation is low, defaults aren't likely to cluster much, and only the equity tranche of a typical CDO would normally be thought of as carrying significant risk of loss. If, on the other hand, correlation is high and defaults tend to come in clumps, then the mezzanine and conceivably even the senior tranches can be hit.

Correlation is by far the trickiest issue in valuing a CDO. Indeed, it is difficult to be precise about what correlation actually means: in practice, its determination is a task of mathematical modelling. Over the past ten years, a model known as the 'single-factor Gaussian copula' has become standard. 'Single-factor' means that the degree of correlation is assumed to reflect the varying extent to which fortunes of each debt-issuer depend on a single underlying variable, which one can interpret as the health of the economy. 'Copula' indicates that the mathematical issue being addressed is the connectedness of default risks, and 'Gaussian' refers to the use of a multi-dimensional variant of the statistician's standard bell-shaped curve to model this connectedness.

The single-factor Gaussian copula is far from perfect: even before the crisis hit, I wasn't able to get a single insider to express complete confidence in it. Nevertheless, it became a market Esperanto, allowing people in different institutions to discuss CDO valuation in a mutually intelligible way. But having a standard model is only part of the task of understanding correlation. Historical data are much less useful here. Defaults are rare events, and producing a plausible statistical estimate of the extent of the correlation between, say, the risk of default by Ford and by General Motors is difficult or impossible. So as CDOs gained popularity in the late 1990s and early years of this decade, often the best one could do was simply to employ a uniform, standard figure such as 30 per cent correlation, or use the correlation between two corporations' stock prices as a proxy for their default correlations.

However imperfect the modelling of CDOs was, the results were regarded by the rating agencies as facts solid enough to allow them to grade CDO tranches. Indeed, the agencies made the models they used public knowledge in the credit markets: Standard & Poor's, for example, was prepared to supply participants with copies of its 'CDO Evaluator' software package. A bank or hedge fund setting up a standard CDO could therefore be confident of the ratings it would achieve. Creators of CDOs liked that it was then possible to offer attractive returns to investors – which are normally banks, hedge funds, insurance companies, pension funds and the like, not private individuals – while retaining enough of the cash-flow from the asset pool to make the effort worthwhile. As markets recovered from the bursting of the dotcom and telecom bubble in 2000-2, the returns from traditional assets – including the premium for holding risky assets – fell sharply. (The effectiveness of CDOs and other credit derivatives in allowing banks to shed credit risk meant that they generally survived the end of the bubble without significant financial distress.) By early 2007, market conditions had been benign for nearly five years, and central bankers were beginning to talk of the 'Great Stability'. In it, CDOs flourished.

Ratings aside, however, the world of CDOs remained primarily one of private facts. Each CDO is normally different from every other, and the prices at which tranches are sold to investors are not usually publicly known. So credible market prices did not exist. The

problem was compounded by one of the repercussions of the Enron scandal. A trader who has done a derivatives deal wants to be able to 'book' the profits immediately, in other words have them recognised straightaway in his employer's accounts and thus in the bonus that he is awarded that year. Enron and its traders had been doing this on the basis of questionable assumptions, and accounting regulators and auditors – the latter mindful of the way in which the giant auditing firm Arthur Andersen collapsed having been prosecuted for its role in the Enron episode – began to clamp down, insisting on the use of facts (observable market values) rather than mere assumptions in 'booking' derivatives. That credit correlation was not observable thus became much more of a problem.

From 2003 to 2004, however, the leading dealers in the credit-derivatives market set up fact-generating mechanisms that alleviated these difficulties: credit indices. These resemble CDOs, but do not involve the purchase of assets and, crucially, are standard in their construction. For example, the European and the North American investment-grade indices (the iTraxx and CDX IG) cover set lists of 125 investment-grade corporations. In the terminology of the market, you can 'buy protection' or 'sell protection' on either an index as a whole or on standard tranches of it. A protection seller receives fees from the buyer, but has to pay out if one or more defaults hit the index or tranche in question.

The fluctuating price of protection on an index as a whole, which is publicly known, provides a snapshot of market perceptions of credit conditions, while the trading of index tranches made correlation into something apparently observable and even tradeable. The Gaussian copula or a similar model can be applied 'backwards' to work out the level of correlation implied by the cost of protection on a tranche, which again is publicly known. That helped to satisfy auditors and to facilitate the booking of profits. A new breed of 'correlation traders' emerged, who trade index tranches as a way of taking a position on shifts in credit correlation.

Indices and other tranches quickly became a huge-volume, liquid market. They facilitated the creation not just of standard CDOs but of bespoke products such as CDO-like structures that consist only of mezzanine tranches (which offer combinations of returns and ratings that many investors found especially attractive). Products of this kind leave their creators heavily exposed to changes in credit-market conditions, but the index market permitted them to hedge (that is, offset) this exposure.

All this activity explains the attractiveness of the end-of-the-world trade. The trade is the buying and selling of protection on the safest, super-senior tranches of the investment-grade indices. No one buys protection on these tranches because they are looking for a big pay-out if capitalism crumbles: if nothing else, they have no reason to expect that the institution that sold them protection would survive the carnage and be able to make the pay-out. Instead, they are looking to hedge their exposure to movements in the credit market, especially in correlation. Traders need to demonstrate they've done this before they're allowed to book the profits on their deals, so from their viewpoint it's worth buying protection, for example from 'monolines' (bond insurers), even if the latter would almost certainly be insolvent well before any pay-out on the protection was due.

With problems such as the non-observability of correlation apparently adequately solved by the development of indices, the credit-derivatives market, which emerged little more than a decade ago, had grown by June 2007 to an aggregate total of outstanding contracts of \$51 trillion, the equivalent of \$7,700 for every person on the planet. It is perhaps the most sophisticated sector of the global financial markets, and a fertile source of employment for mathematicians, whose skills are needed to develop models better than the single-factor Gaussian copula.

The credit market is also one of the most computationally intensive activities in the modern world. An investment bank with a big presence in the market will have thousands of positions in credit default swaps, CDOs, indices and similar products. The calculations needed to understand and hedge the exposure of this portfolio to market movements are run, often overnight, on grids of several hundred interconnected computers. The banks' modellers would love to add as many extra computers as possible to the grids, but often they can't do so because of the limits imposed by the capacity of air-conditioning systems to remove heat from computer rooms. In the City, the strain put on electricity-supply networks can also be a problem. Those who sell computer hardware to investment banks are now sharply aware that 'performance per watt' is part of what they have to deliver.

The boom in credit derivatives had wider effects, in particular increasing the appetite for low-grade debt. A typical CDO, if it is to offer an attractive enough return to investors, has either to purchase risky (and thus high-yielding) bonds or loans in significant quantity, or to sell protection on such bonds and loans via credit default swaps. This fuelled the growth in private equity groups, which buy companies by borrowing very heavily, often by issuing large quantities of bonds. Because of the riskiness of heavily-indebted enterprises these bonds can achieve only junk ratings, but were attractive nonetheless to the creators of CDOs.

Fatally, the demand for risky debt – which arose not just from CDOs, but from the sharply reduced returns available from safer assets more generally – also encompassed bonds based on sub-prime mortgages: home loans that are risky, usually because the borrower has a blemished credit record, but also because the loan-to-value or loan-to-income ratio is high, documentation is poor, or it's a buy-to-let purchase or second mortgage. It is now well known that problems in the US sub-prime sector caused the credit market to turn in summer 2007 from boom to crisis.

It is important, however, to keep a sense of scale. Last autumn, the Bank of England calculated that bonds backed by US sub-prime mortgages totalled \$0.7 trillion. That's a lot of money, but it makes up only 2.5 per cent of the total value of non-governmental bonds and corporate loans outstanding worldwide. Sub-prime's \$0.7 trillion is, for example, dwarfed by the \$11 trillion corporate bond market, of which \$10.2 trillion is investment grade. Indeed, what is perhaps most striking about the credit crisis is that corporations outside the financial sector have remained generally in robust economic health, with bankruptcies and thus default rates at historic lows. Not a single investment-grade corporation has defaulted recently, and there haven't even been any recent large-scale speculative-grade corporate defaults.

Problems spilled over from sub-prime to sectors that hadn't been experiencing financial distress in good part because of damage to the credit market's fact-generating mechanisms. The rating agencies had graded products underpinned by sub-prime mortgages on the basis of previous experience of default rates and of the proceeds of the sale of repossessed properties, but had failed to take into account the effects of the bubble in housing prices in the US, the way in which the growth of mechanisms for transferring credit risk and the increased appetite for risky debt had altered the US mortgage market. Predatory and irresponsible lending by commission-hungry brokers had been encouraged by the way in which even the riskiest mortgages could so easily be packaged and sold on, leaving the original mortgage-lender free of losses in the event of default. Mortgage-backed products that the rating agencies had ranked as investment-grade started to incur major losses, and the agencies had to revise many ratings sharply

downwards. To take an extreme but not wholly untypical case, Moody's downgraded the top tranche of one mortgage-backed CDO by 14 notches. When it was issued in April last year the tranche was rated Aaa, the top of investment grade; by November, it was rated B2, well down in junk.

The rating agencies are businesses, and the issuers of debt instruments pay the agencies to rate them. The potential conflict of interest has always been there, even in the days when the agencies mainly graded bonds, which generally they did quite sensibly. However, the way in which the crisis has thrust the conflict into the public eye has further threatened the credibility of ratings. 'In today's market, you really can't trust any ratings,' one money-market fund manager told Bloomberg Markets in October 2007. She was far from alone in that verdict, and the result was cognitive contagion. Most investors' 'knowledge' of the properties of CDOs and other structured products had been based chiefly on ratings, and the loss of confidence in them affected all such products, not just those based on sub-prime mortgages. Since last summer, it has been just about impossible to set up a new CDO.

Even more damagingly, the credit world's existing special purpose vehicles have found it harder and harder to obtain funds from the source that usually sustains them, the sale of 'commercial paper' (short-term debt). Consequently, some vehicles have had to sell assets – not just mortgage-backed securities, but corporate loans and corporate bonds – to raise cash.

The result of such forced selling, and the unwinding of positions in other sectors of the credit derivatives market, has been a sharply increased demand for protection, and much-diminished willingness to sell it. As a result, the cost of protection has soared across all sectors of the credit market. The safest instruments have been affected as well as the riskiest ones, paradoxically sometimes to an even greater degree. For example, the returns from holding safe assets or selling protection on the safest index tranches were in the recent past paltry, so it was common for hedge funds and other market participants to finance such positions by borrowing, or by multiplying returns (and also potential losses) in other ways; this is called 'leverage'. A popular product, for example, has been 'leveraged super-senior', investors in which sell end-of-the-world insurance, but with returns and risks multiplied by about ten.

If you're levered up, even relatively modest market movements can force you to liquidate your positions in a hurry to stop your losses becoming catastrophic. Leveraged super-senior and similar products, for example, typically have specified 'unwind points': thresholds, such as loss levels, at which the deal has to be unwound by buying protection equivalent to the protection one has sold. With what Jon Gregory of Barclays Capital estimates in Risk magazine to be around \$100 billion of leveraged super-senior protection having been sold, even the fear of approaching unwind points can be deeply disturbing to the markets.

Processes of this kind – changes internal to the world of credit derivatives, not in the level of the risks being insured against – have meant that investment-grade indices sometimes move by up to 20 per cent in a single day. At times, the price of end-of-the-world insurance has corresponded to utterly implausible correlation levels in excess of 90 per cent: meaning, in effect, that if one investment-grade corporation were to default, almost all of them would.

Why aren't such mispricings being corrected by savvy investors, eager to seize the opportunities for profit they create? Why, for example, have people not been selling end-

of-the-world insurance when the returns from doing so have jumped ten-fold while the risk of having to pay out remains small? A crucial part of the answer is that, paradoxically, a fact-generating mechanism is blocking the restoration of fact. The mechanism is 'marking-to-market', the compulsory revaluation of portfolios as market prices fluctuate. Its motivation is entirely sensible: for example, when regulators insist that banks mark-to-market, it should force them to disclose losses to their investors and creditors.

Unfortunately, however, marking-to-market makes market participants extremely sensitive to short-term price fluctuations. To sell end-of-the-world insurance, for example, is almost certainly an excellent long-term bet, but traders don't do it because of the fear that in the short run its price may increase even further, causing a mark-to-market loss. Although it would be a paper loss, it would have real consequences, damaging your bank's balance sheet and profits, threatening your bonus, and typically forcing you to transfer valuable collateral to the custody of the buyer of the insurance.

Over recent months, banks have frequently been accused of hiding their credit losses. The truth is scarier: such losses are extremely hard to measure credibly. Marking-to-market requires that there be plausible market prices to use in valuing a portfolio. But the issuing of CDOs has effectively stopped, liquidity has dried up in large sectors of the credit default swap market, and the credibility of the cost of protection in the index market has been damaged by processes of the kind I've been discussing.

How, for example, can one value a portfolio of mortgage-backed securities when trading in those securities has ceased? It has become common to use a set of credit indices, the ABX-HE (Asset Backed, Home Equity), as a proxy for the underlying mortgage market, which is now too illiquid for prices in it to be credible. However, the ABX-HE is itself affected by the processes that have undermined the robustness of the apparent facts produced by other sectors of the index market; in particular, the large demand for protection and reduced supply of it may mean the indices have often painted too uniformly dire a picture of the prospects for mortgage-backed securities. One trader told the Financial Times in April that the liquidity of the indices had become very poor: 'Trading is mostly happening on interdealer screens between eight or ten guys, and this means that prices can move wildly on very light volume.' Yet because the level of the ABX-HE indices is used by banks' accountants and auditors to value their multi-billion dollar portfolios of mortgage-backed securities, this esoteric market has considerable effects, since low valuations weaken banks' balance sheets, curtailing their capacity to lend and thus damaging the wider economy.

Josef Ackermann, the head of Deutsche Bank, has caused a stir by admitting 'I no longer believe in the market's self-healing power.' The state has had to stand between the market and the abyss. Had the British government not rescued Northern Rock, bank runs would have brought down other institutions and destroyed confidence in the UK's financial system. Had the Federal Reserve not bailed out Bear Stearns, at least one other major Wall Street bank would most likely have failed, and chaos might have ensued. With private lending having dried up, government-sponsored lenders now provide 90 per cent of the funding of new mortgages in the US.

Modern central banking, backed ultimately by the tax payer, can almost certainly prevent financial catastrophe on the scale of 1929. Restoring normality, which requires repairing the cognitive state of modern finance, is quite a different matter. As Carruthers and Stinchcombe note, market liquidity depends on facts. However, today's financial facts depend on liquidity. The credit markets remain stuck in a vicious circle.

There are some signs that repair might be possible. Pension funds, which are under less immediate pressure to mark-to-market, have started to sell end-of-the-world insurance, and if they do so on a larger scale, liquidity and thus credible prices may return to that part of the index market. The rescue of Bear Stearns persuaded many traders that the Federal Reserve will not allow any major US bank to collapse, and a \$19 billion write-down (a reduction in the balance-sheet valuation of its portfolio) by the Swiss Bank UBS in early April was widely seen as a nadir, the valuation now so low that it was unlikely to fall much further.

But there have been false dawns before. In early October 2007, as US banks first started to report large write-downs of their credit portfolios, their share prices surprisingly soared. 'It seems that the more money you lose,' one banker told the Financial Times, 'the more your shares go up.' It had begun to seem as if the banks had the measure of the crisis, and facts were on the way to being restored. However, that impression quickly evaporated as within weeks the estimates of losses jumped upwards. For example, by 20 October Merrill Lynch had increased its estimate of its losses from \$4.5 billion to \$7.9 billion. That's the problem with facts. Once they fall apart, they are very difficult to put back together again.

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HEDGE FUNDS AS NOMADIC WAR MACHINE

İsmail Ertürk

Good finance / bad finance

Hedge funds occupy an ambiguous space in today's financial landscape. The hedge fund industry is small in size compared to banks and pension funds. The total size of the industry was about 2 trillion US dollars at its peak in 2007 before the crisis. Most giant banks are as big as the total size of the hedge fund industry. The Citibank, for example, alone has a similar size. But the impact of hedge funds on the economy and the financial markets is substantial. Politicians got publicly angry when hedge funds forced sterling out of the Exchange Rate Mechanism in 1992; brought the dream of Malaysia becoming a first world nation to an end by causing the mega-devaluation of ringgit in 1997; deepened the banking crisis of 2008 by short-selling stocks of mighty banks in the US, UK and the EU; threatened the currency union in the EU by using naked credit default swaps against Greek sovereign debt in 2010.

Hedge funds defend themselves against these accusations of destabilising speculators by counter-stating that they are merely instruments of market forces that make politicians face the economic reality and stop them from lying to the people they rule about the true state of the economy. Banks were a heap of toxic assets before the crisis and hedge funds revealed that by short selling bank shares. Greece's finances were in big mess and hedge funds showed this to the world by pushing insurance premium for Greek sovereign debt (so called credit default swaps) upwards. Mainstream economists theoretically support this line of defence by hedge funds. In academic jargon, hedge funds are arbitrageurs who bring efficiency to the financial markets, help efficient allocations of funds in the economy. Are hedge funds villain-speculators as their opponents allege or agents of financial efficiency as their friends defend?

Although, in our financialized kind of capitalism, the identity and the role of hedge funds are unclear their self-representation does not lack clarity. They self-represent themselves to the regulators and policy makers as agents of efficiency in financial markets and to the investment community as alternative investments delivering alpha return- i.e. they make money both in good times and bad times. But this alchemistic claim was proven to be untrue after the financial crisis of 2008. Average annual return on hedge funds over longer periods is not superior to other passive investment strategies. Hedge funds suffered huge losses just like other funds after the crisis. They can only make money if the economic conjuncture is right and as long as they have access to the services of big investment banks through prime brokerage relationship.

Deleuze and Guattari on nomadology

How do we then describe this complex character of hedge funds? We need to resort to the theoretical tool box of non-economists. The history of ideas, anthropology, and sociology provide good insights to the identity and role of hedge funds. The analogy that describes them best is nomadic war machine as theorized by the French philosophers

Deleuze and Guattari in their "Treatise on Nomadology: The War Machine" in *A Thousand Plateaus – Capitalism and Schizophrenia*. The following quotations from Deleuze and Guattari describe what a nomadic war machine is: "In every respect the war machine is of another species, another nature, another origin than the State apparatus"; "From the standpoint of the State, the originality of the man of war, his eccentricity, necessarily appears in a negative form: stupidity, deformity, madness, illegitimacy, usurpation, sin..."; "(The war machine) brings secrecy against the public, a power against sovereignty, a machine against the apparatus". These descriptions fit hedge funds perfectly. Hedge funds are "unregulated", "secretive", "alternative" investments challenging all definitions of sovereign power. They pose a threat to the system.

But nevertheless the relationship between the war machine and the state is not a simple relationship of opposition and rivalry but one of mutual deterritorializing and reterritorializing of space – coexistence and competition in a perpetual field of interaction. For example when Goldman Sachs sold toxic assets to investors through its Abacus transactions of synthetic collateralized debt obligations (CDOs) between 2004 and 2007 it needed the cooperation of the hedge fund Paulson & Co. Hedge funds cannot operate without access to prime brokerage services of established investment banks. In 2008 hedge funds created total revenue of \$11 billion for investment banks that provided prime brokerages services. Investment banks lend funds the securities they need to undertake short sales and also lend hedge them money to leverage their investments. Investment banks trade and perform global custody services for the assets hedge funds acquire, and provide 'back office' accounting and portfolio information services. The US army needed Sunni militia in Iraq to fight Al-Qaeda. Laurent Nkunda and his guerrillas were linked to Rwandan government and Western economic interests against Chinese influence in their fight against the Democratic Republic of Congo. Nomadic war machines are usually equipped, armed and supported by regular state armies. Hedge funds cannot short Greek government bonds without loans and brokerage services from big reputable banks. With such support from the establishment hedge funds turn tools into weapons.

Hedge funds turn tools into weapons

Derivatives like contracts for difference (CFD) and the practice of short selling are financial transactions that are allowed by the regulators because they are believed to help create efficiency in the stock markets. In this sense they are useful tools to be legitimately deployed by financial institutions. But their recent use by hedge funds was considered to be damaging. Hedge funds turned tools into weapons. In 2007 the Financial Services Authority of the U.K. warned activist hedge funds not to conspire to mislead the market by using equity derivatives like CFDs. CFDs allow buyers to bet on share price movements without actually owning the shares. However on demand the seller of CFDs have to deliver the underlying shares to the buyer. Therefore such contracts allow buyers to enjoy the economic rights on the underlying shares without owning them. However if the buyer exercises his/her right to buy the underlying shares from the seller, which is usually an investment bank, then overnight the buyer becomes a shareholder with voting rights in the company. The FSA thought that the use of CFDs by hedge funds, which were responsible for about 30% of equity trades in London Stock Exchange in 2007, could cause potential market failure. The event that triggered the FSA's move was the Children Investment Fund's use of CFDs in putting pressure on the ABN Amro management to sell or break-up the bank.

Similarly the short selling of bank shares by hedge funds in 2008 was considered no longer to be a tool to create market efficiency when the authorities globally banned short selling by hedge funds. Hedge funds were accused of sending bank share prices dangerously south and destabilizing the government efforts to recapitalize the banking system. It was not only the governments who accused hedge funds turning a tool into a weapon. The Archbishop of York John Sentamu called hedge funds "bank robbers". Richard Fuld, former CEO of the fallen Lehman Brothers, too, blamed hedge funds for short selling his banks' shares and therefore bringing his bank's demise. The nomadic war machine turns against its sovereign sponsor.

In the aftermath of the corporate scandals in the first couple of years of the 21st century corporate governance reforms like Sarbanes Oxley in the US and Combined Code in the UK encouraged shareholder activism. Shareholder activism is promoted in these important corporate governance codes as a useful and necessary tool to control managers effectively to help resolve the agency problem. Since then a number of hedge funds have used shareholder activism to influence corporate strategy and payout policies to generate high returns. Carl Icahn, William Ackman, Nelson Peltz, Chris Hohn, Eric Knight have used their hedge funds to pursue shareholder activism in companies like Time Warner, McDonald's, Cadbury Schweppes, Deutsche Borse, Shell etc. They used legitimate tools like proxy fights – asking shareholders to vote on key initiatives at annual general meetings –, hostile 13-D letters – public vehicles to criticize management to effect change –, equity derivatives like contracts for difference (CFDs) and swaps and short selling of stocks. When Chris Hohn's The Children's Investment Fund (TCI) used shareholder activism to stop Deutsche Borse to bid for London Stock Exchange and instead to use the cash to pay higher dividends, the German Vice Chancellor Franz Müntefering famously called hedge funds "financial locusts". In Germany, shareholder activism by hedge funds were considered to be a dangerous weapon damaging the German economy and industry rather than a tool to effect good governance and better corporate performance.

The latest example of the use of a financial tool as a weapon by hedge funds occurred during the Greek sovereign debt crisis. Credit default swaps were created to protect bond investors against default. These are basically insurance policies that pay out when a debt holder defaults. Hedge funds were believed to be holding such insurance without having an exposure to the Greek government. This is called naked credit default swap. This kind of investment strategy generates high returns when the credit rating of the Greek government bonds decline or when investors start demanding higher risk premiums on Greek government debt. Hedge funds were believed to have manipulated the Greek bond markets to increase the risk premiums which then made their holding of credit default swaps of Greek government bonds very profitable. The Greek Prime minister Papandreu called for banning credit default swaps saying: "It is common sense, enforced by insurance regulators, that a person is not allowed to buy fire insurance on his neighbour's house – and then burn it down to collect on that insurance." The war machine does not agree and sharpens his weapons instead. This is hedge fund manager Dermot S. L. Butler's response to the Euro's problems: "Hedge fund activity will ultimately reduce or eliminate market inefficiencies – but, in this case, market instability or volatility results from the Central Bank's intervention for the (their) 'National Interest' is likely to continue to provide investment trading and speculative opportunities which hedge fund managers can and should take advantage of, in the interest of their investors." The current financial landscape continues to create spaces to roam and villages to pillage for our modern nomadic war machines of hedge funds.

TOP 5 HEDGE FUND WEAPONS

1. NAKED CREDIT DEFAULT SWAPS

Credit default swaps are insurance products against default of a borrower. A bond investor is exposed to default risk – the probability that the issuer of the bond will not be able to or unwilling to pay the capital back. Hedge funds buy such insurance without investing in the bonds. Hence the name “naked”. This is a speculative move which will only generate profit if the bond issuer’s credit rating deteriorates. And hedge funds are alleged to have manipulated the markets to cause downgrading of Greek government bonds for example.

2. CONTRACTS FOR DIFFERENCE

CFDs allow buyers to bet on share price movements without actually owning the shares. Such contracts allow buyers to enjoy the economic rights of the underlying shares without owning them. Hedge funds used CFD to force companies to act in hedge funds’ short-term financial interests rather than the long-term shareholders’ interest. A hedging instrument is used for speculative purposes at the expense of other long-term shareholders.

3. SHORT SELLING

Hedge funds are alleged to have used short selling to depress the share prices of banks to gain financial profits. Hedge funds borrow the shares from institutional investors and sell them immediately. Such selling and spread of rumours about the company bring the share price down. Hedge funds buy the shares when the price goes down and return to share lender at a profit.

4. HOSTILE 13-D LETTERS

Shareholders can use 13-D letters to publicly criticize the managers to force them to act in shareholders’ interest. Hedge funds use 13-D letters to force the management to act in hedge funds’ short-term interest. For example hedge funds can force management to divest, enter into mergers and acquisitions or pay dividend. These have impact on share prices and dividend payments that benefit hedge funds.

5. HIGH FREQUENCY TRADING

Hedge funds use computer technology to influence share prices by sending buy and sell orders quicker than any other investors. They use their locational position – physical distance to the exchange computers – to gain advantage over prices and to influence prices for their own financial interest at the expense of other market participants. Such trading can also cause market crash.

fig. 2.2.1

İsmail Ertürk lists hedge fund weapons

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