CREDIT RISK MANAGEMENT FOR SOLAR ASSET FINANCE

November 18, 2020

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Logistics

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- We will be sharing the presentations following the event

- Please post questions during the session in the Chat (send to 'EVERYONE')

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    - Click 'Participants',
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Agenda (all times GMT)

11:00	Introduction
11:10	Transaction Risk
11:15	Product Design
11:35	Credit Assessment
12:20	Monitoring & Collections
12:45	Break
13:00	Expected Loss
13:20	Metrics and Analytics
14:00	Case Studies
14:30	Data and Dashboards

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Poll Question #1:
What is your personal risk appetite?

1. *Zero: I don't go outside if it might rain*
2. *Low: I wore a mask everywhere before the pandemic*
3. *Moderate: I do not always wear a helmet on motorcycles*
4. *High: I go rock-climbing on the weekend, without ropes*

Facilitator

Walter Tukahiirwa, CFA

Risk Management Specialist

NESTOR

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The Voice of the Off-Grid Solar Energy Industry

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Rebecca Rhodes

Project Manager, Consumer Protection and Technology

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Objective of this webinar

- Understand the nature and drivers of default in credit
- Understand credit assessment techniques
- Interpret credit portfolio performance
- Best practices for credit losses

CREDIT TRANSACTION RISK

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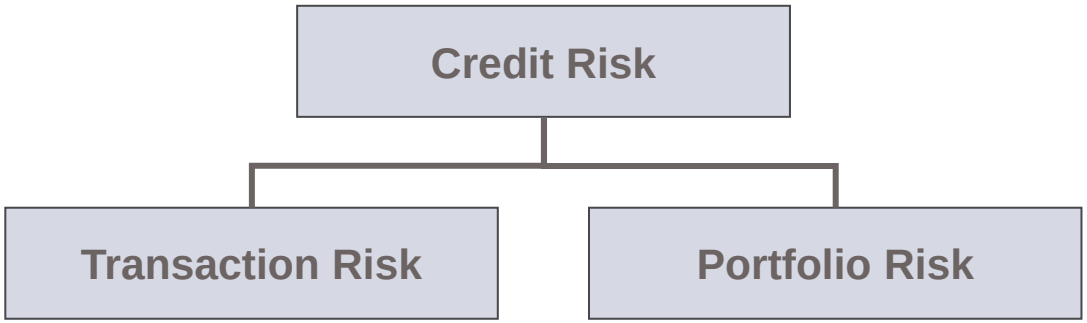
Credit Risk – Definition

- **Credit risk:** possibility that a borrower or other contractual counterparty might default, i.e. might fail to honor their contractual obligations.
- **Migration risk:** potential deterioration of the credit quality of an un-defaulted exposure

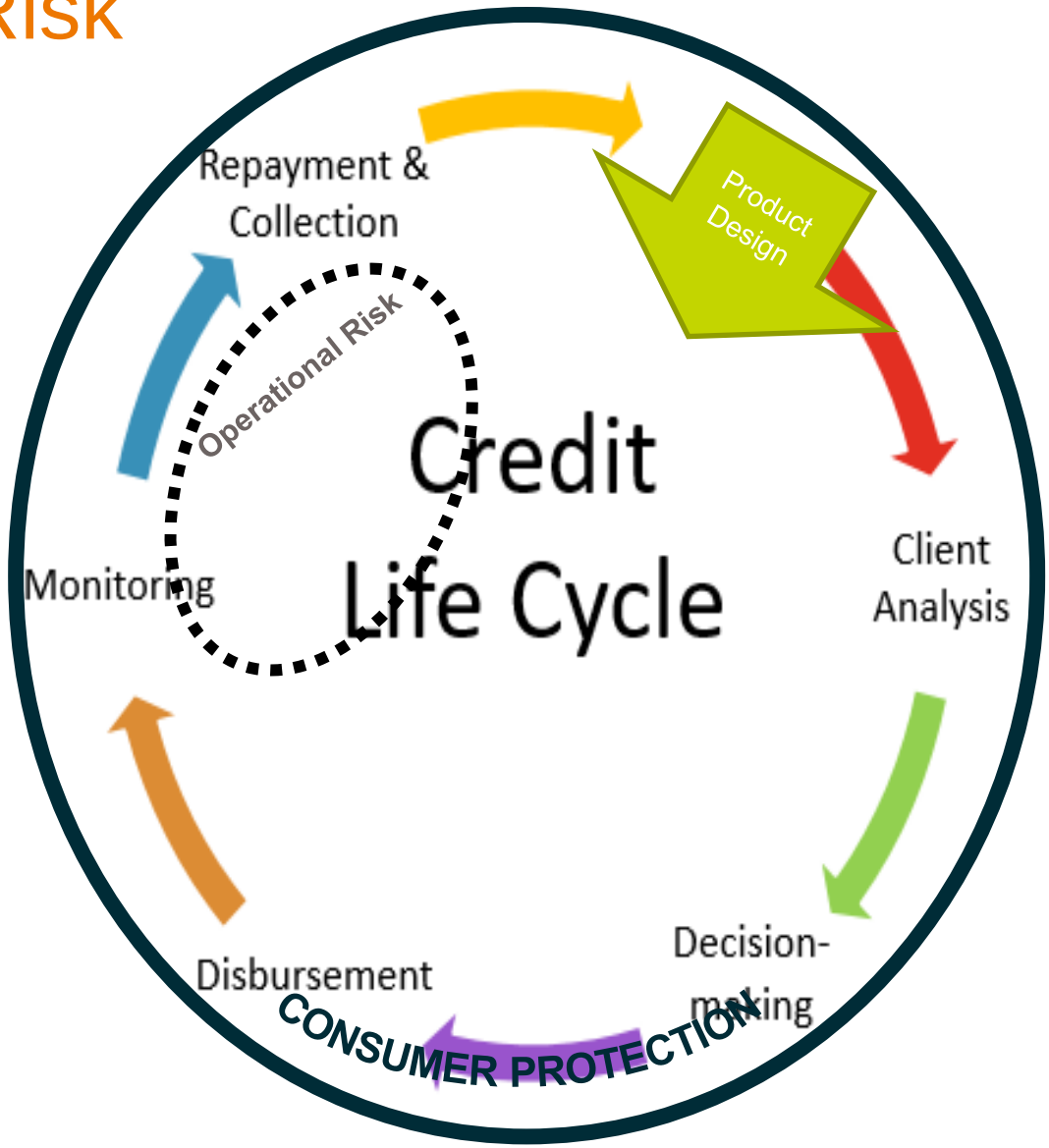


- **Transaction risk** refers to individual loans and essentially measures (1) the standalone probability that the borrower will be able to repay, as well as (2) the ultimate loss in the case of a borrower default after use of collateral and other mitigating factors.
- **Portfolio credit risk** is concerned with measuring correlations between individual borrower defaults, the effects of diversification, the cyclicality of collateral values and the implications of reputation and contagion effects.

Credit Transaction Risk

THE CREDIT LIFE CYCLE

- Similar to financial institution
- Disbursement requires exchange of physical goods
- Collections may include repossession
- Operational risk arises at all stages of the credit life cycle
- Consumer protection should guide all aspects of customer interaction



Product Design

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Product Design

Credit Technology

Technological innovation has been a key enabler in reaching low-income customers

- Remote lock-out
- GPS tracking
- Communication platforms
- Analytics

Financial product design

Main considerations for the 'financial product' include

- Tenor
- Repayment flexibility
- Risk-based pricing and provisioning
- Interest rates

Product Design

Asset finance begins with the physical product design. Key risk factors to consider include

Quality	• Objective measures e.g. hours of light • Subjective measures e.g. product features
Durability	• Product malfunctions
Longevity	• Depreciation • Resale/ Refurbishment
Dependency	• Required infrastructure to operate product
Interoperability	• Links with other products • Impact of proprietary product ecosystems
Value for Money	• Do product benefits far outweigh costs

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Effective Interest Rates

Traditional Interest Rate Components:

- Cost of funds
- Loan loss expense
- Operating expense
- Profit

This gets significantly more complicated in vertically-integrated models…

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Repayment flexibility

Most PAYGo companies allow borrowers to make flexible repayments, without forcing them to repay missed payments ('arrears')

Advantages	Challenges
• Aligns with sporadic incomes of low-income households • Creates a more 'on-demand' customer experience • Allows poorer customers to lower the effective price by regularly skipping days	• Failure to develop repayment discipline • Early repayers may pay higher effective interest rates • Makes portfolio health difficult to assess and communicate

The only way to solve these problems is with data, which requires iteration

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Extreme affordability is the key to universal energy access. But lengthening tenors is not the same thing

Imagine a $120 SHS with a $20 deposit.

Months	Monthly Payment	Total Cost
12	$10.24	$142.88
24	$6.11	$166.66
36	$4.80	$192.89

At first glance, one of these seems obviously preferable. But it's not that simple

Loan tenor and credit risk, continued

But if we hold loan principal constant and increase the tenor, a few things happen:

Cost of funds and OpEx go up

Iterative learning decreases

Cost of risk goes up, fast

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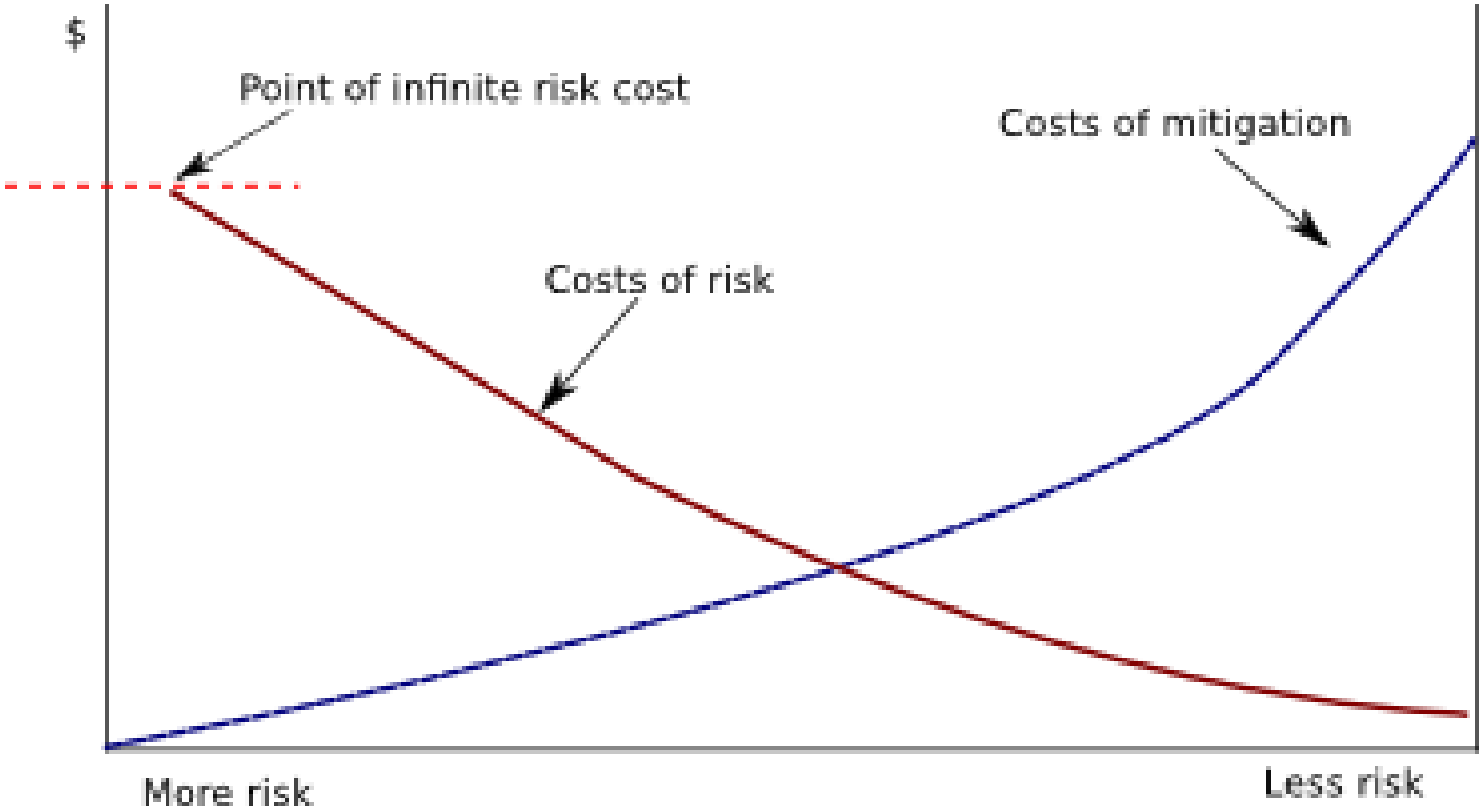
In our experience the cost of risk is often not provisioned fully, nor is it always priced in…

We owe it to customers to minimize the cost of risk



There is no perfect PAYGo product, but we can get closer

- Keep loans as short as possible, and as long as necessary
- Price in expected losses, and reduce prices by managing credit risk
- Acknowledge the time value of money
- Experiment with risk-based pricing
- Iterate!

Q&A

Credit risk assessment

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Poll Question #2: What does your company's credit assessment look like?

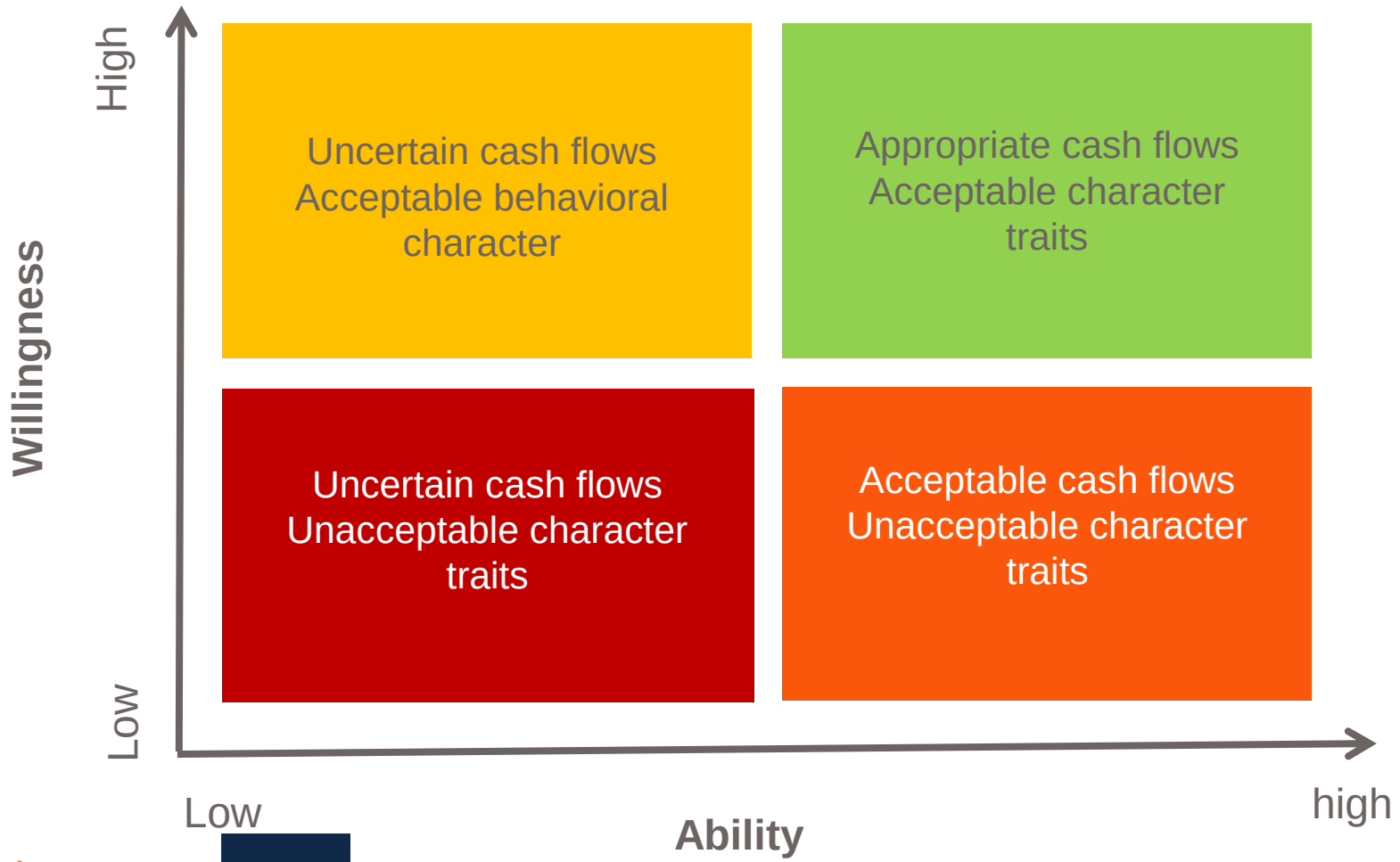
1. *There is no assessment beyond basic KYC. If a customer can afford the deposit, they get the unit.*
2. *We ask a few questions to weed out potential fraud, but we reject very few customers.*
3. *We have a robust credit scorecard that we administer for every potential client and reject more than 10% of applicants.*
4. *Our process looks like #1 for small systems, and #3 for larger systems.*

Credit risk assessment

- **Involves assessing likelihood that loan shall be repaid**
- **Two primary dimensions:**
  - Ability to pay
  - Willingness to pay
- **Consumer credit assessments conducted via:**
  - Judgment, based on client interviews
  - Automation, especially statistical credit scoring
  - Credit ratings, especially for larger loan sizes
  - Judgment, supported by scoring or rating

Credit risk assessment

Ability/Willingness matrix



Credit assessment

- PAYGo providers have experienced rapid growth in portfolio with limited use of assessment best practices
  - Use of group solidarity lending techniques such as upfront savings, group guarantees etc
  - Home visits prior to lending
  - Use of credit bureaus where available esp. for larger value transactions
  - Requiring guarantors/ references
  - Credit approval limits based on hierarchy or performance
- **Providers should aim for optimal trade-off between growth and risk management**

1 What is Scoring?

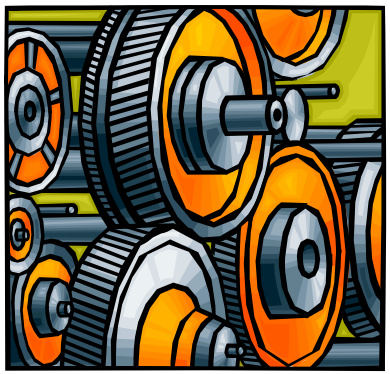
Statistical Credit Scoring

- Scorecards use predictive statistical models (discriminant analysis or logistic regression) applied to the behavior of previous customers: i.e. a database of descriptors / demographics combined with a subsequent performance record.
- With credit scoring, lenders obtain ex-ante visibility of the Probability of Default.
- Together with LGD & EAD estimates, lenders now have a basis for risk-based pricing of individual clients, particular products or client groups.

Database

- Loan Contract
- Socioeconomic descriptors
- Default (yes/no)

Statistical Model



Score Result

Score Value

High Risk: Reject
Medium Risk: Review
Low Risk: Accept

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Statistical credit scoring: Data points

- Track a wide variety of predictive points
- **Loan cycles must be completed**
- Back testing on separate data
- Periodic review of scoring model

Qualitative	Personal Data	Age	Marital Status	Gender
		Education	Banking Experience	Years at Address
	Living	No. of Dependents	No. of Children	Region
	Business	Sector	Location	No. of Employees
Quantitative	Financial	Seasonality of cash-flows	Requested Loan Amount	Loan Product
		Ratios	Payment Capacity	Credit Bureau
	Collateral	Land Value	Personal Guarantee	Movable Collateral

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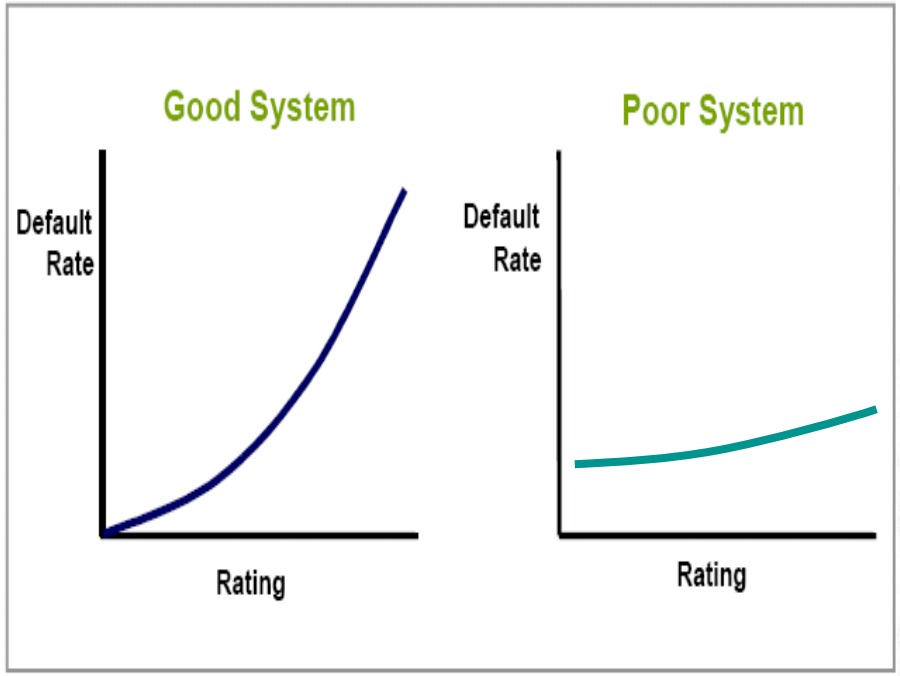
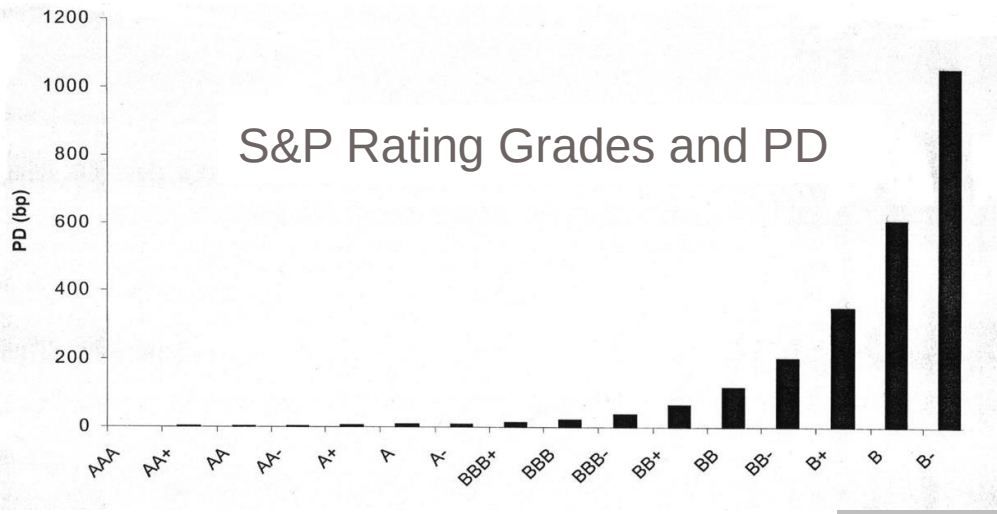
2 Rating & Expert Scoring

SME Rating Models

- Rating models should be reasonably evenly distributed across a minimum number of grades borrowers.
- The need for competitive pricing for risk also requires a finely graded rating model or scoring system.

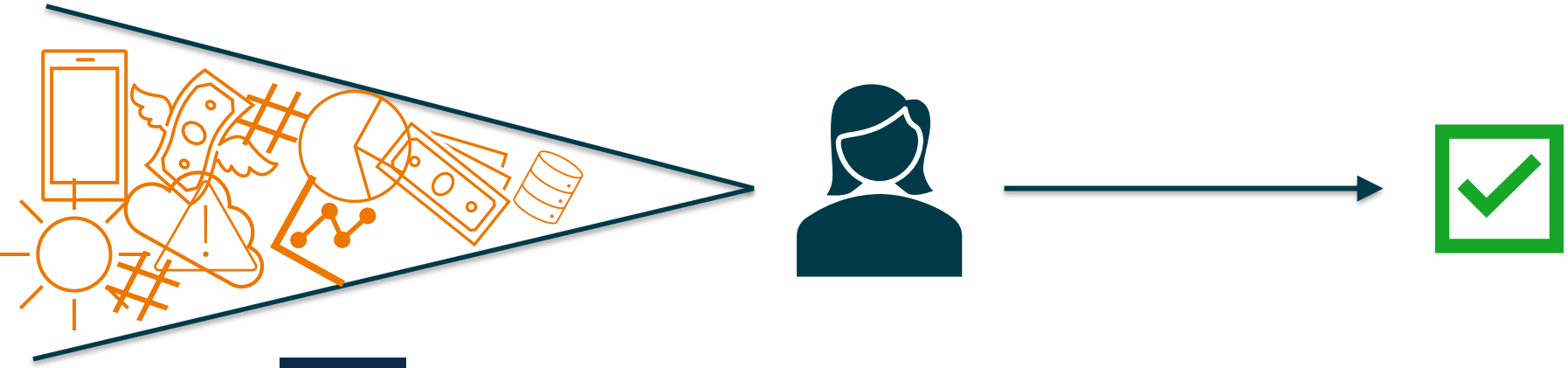




2 Rating & Expert Scoring

Expert Scoring versus Rating

- An expert scoring looks much like a **simplified rating model** that is specifically tailored to consumer credit
- Expert scoring typically assesses credit risk directly in terms of an **all-in expected loss i**n the technical sense of EL = PD*EAD*LGD.
- An expert scoring model will contain risk factors that may impact any of the three risk parameters PD, EAD or LGD.
- **Who are the experts:** Credit staff from entity



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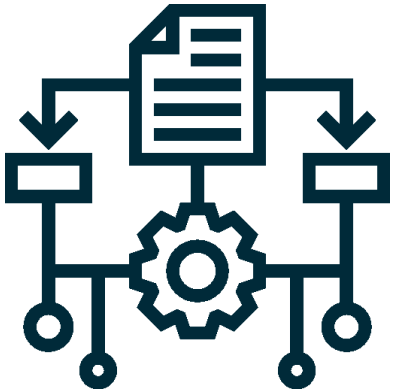
Expert Scoring versus Statistical Scoring

What is better: statistical scoring or judgment-based expert scoring?

- The predictive performance of expert scoring will have to be **statistically validated**.
- The **statistical scoring** measures not how we think or wish that the borrowers might behave, but how they actually paid.
- A **statistical model** also has a built-in algorithm for determining the criteria weights that combine the various risk factors into a single score result. This summary score optimally discriminates between probable good and probable bad clients.

V.



Expert Scoring versus Statistical Scoring

What is better: statistical scoring or judgment-based expert scoring?

- The **central challenge in expert scoring** is how to weigh and combine the scoring elements. This synthesis remains arbitrary and is always a source of debate in expert scoring.
- Most lenders opt for expert scoring out of necessity, because the data history for calculating a statistical credit scoring model just is not there:
  - Few disbursed loans
  - Insufficient data
  - Few defaulted loans in the data history

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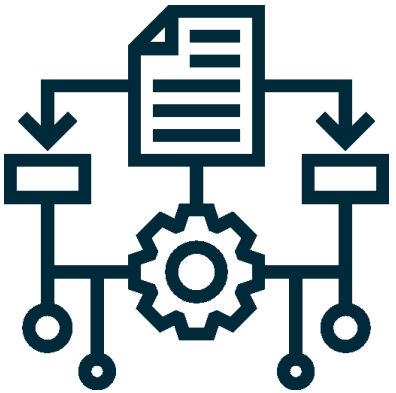

4 Expert Scoring

Practical considerations

- Use minimally invasive customer data such as age, gender, family size etc.
- Collecting data, say incomes, to assess ability to pay is very difficult
- Consider asset based information eg. Using the Poverty Probability Index (PPI)
- Build internal data on customer behavior e.g. expert scores, repayment behaviour, location. Ultimately this would be used to develop statistical credit scoring tools

Sample PPI: Kenya 2015

Kenya 2015 PPI® Survey Questionnaire			
	Questions		**Response Options**
1	In which county does the household reside?	A	Mombasa
		B	Kwale
		C	Nairobi
		D	…
2	What is the highest educational level that the female household head/spouse reached?	A	Pre-primary, none, or other
		B	Primary
		C	Secondary or post-primary, vocational
		D	College level or higher
		E	There is no female household head/spouse
3	What is the highest educational level that any member of the household reached?	A	Pre-primary, none, or other
		B	Primary
		C	Secondary or post-primary, vocational
		D	College level or higher
4	Over the past 7 days, did the household either purchase/consume/acquire any bread?	A	Yes
		B	No
5	Over the past 7 days, did the household either purchase/consume/acquire any meat or fish?	A	Yes
		B	No
6	Over the past 7 days, did the household either purchase/consume/acquire any ripe bananas?	A	Yes
		B	No
7	Does your household own any towels?	A	Yes
		B	No
8	Does your household own any thermos flasks?	A	Yes
		B	No
9	What is the predominant wall material of the main dwelling unit?	A	Finished walls (cement, stone with lime/cement, bricks, cement blocks, covered adobe, or wood planks/shingles)
		B	Uncovered adobe, plywood, cardboard, reused wood, or corrugated iron sheets
		C	Natural walls (cane/palm/trunks, grass/reeds, or mud/cow dung), no walls, bamboo with mud, stone with mud, or other
10	What is the predominant floor material of the main dwelling unit?	A	Natural floor (earth/sand or dung) or palm/bamboo
		B	Other (including wood planks/shingles, parquet or polished wood, vinyl or asphalt strips, ceramic tiles, cement, or carpet)

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GUEST SPEAKER

Holger Siek

Senior Risk Mgmt. Expert,

Frankfurt School of
Finance and Management

Who has had success or challenges with credit assessment that you can share?

Credit Documentation

Clients are most responsive before disbursement

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Decision making

Disbursement and risk management

1. Verification – opportunity to verify self reported data
2. Training – the better the client is trained on how to handle the asset, the more likely they will be inclined to pay
3. Time - delays in installation and delivery could impact repayment e.g. water pumps and seasonality

Credit Monitoring

Daily tracking by key management

Objectives of Credit Monitoring

1. Keep track of borrower's willingness/ability to pay
2. Early detection of potential default. Some warning signs for individuals include:
    i. Request to extend the grace period or restructure account
    ii. Arrears on the account e.g. increasing cumulative days not topped up
    iii. Customer is no longer available or non-responsive
    iv. Increased largesse and expensive lifestyle
    v. Change in customer behaviour – arrogance, rudeness, dishonoring commitments

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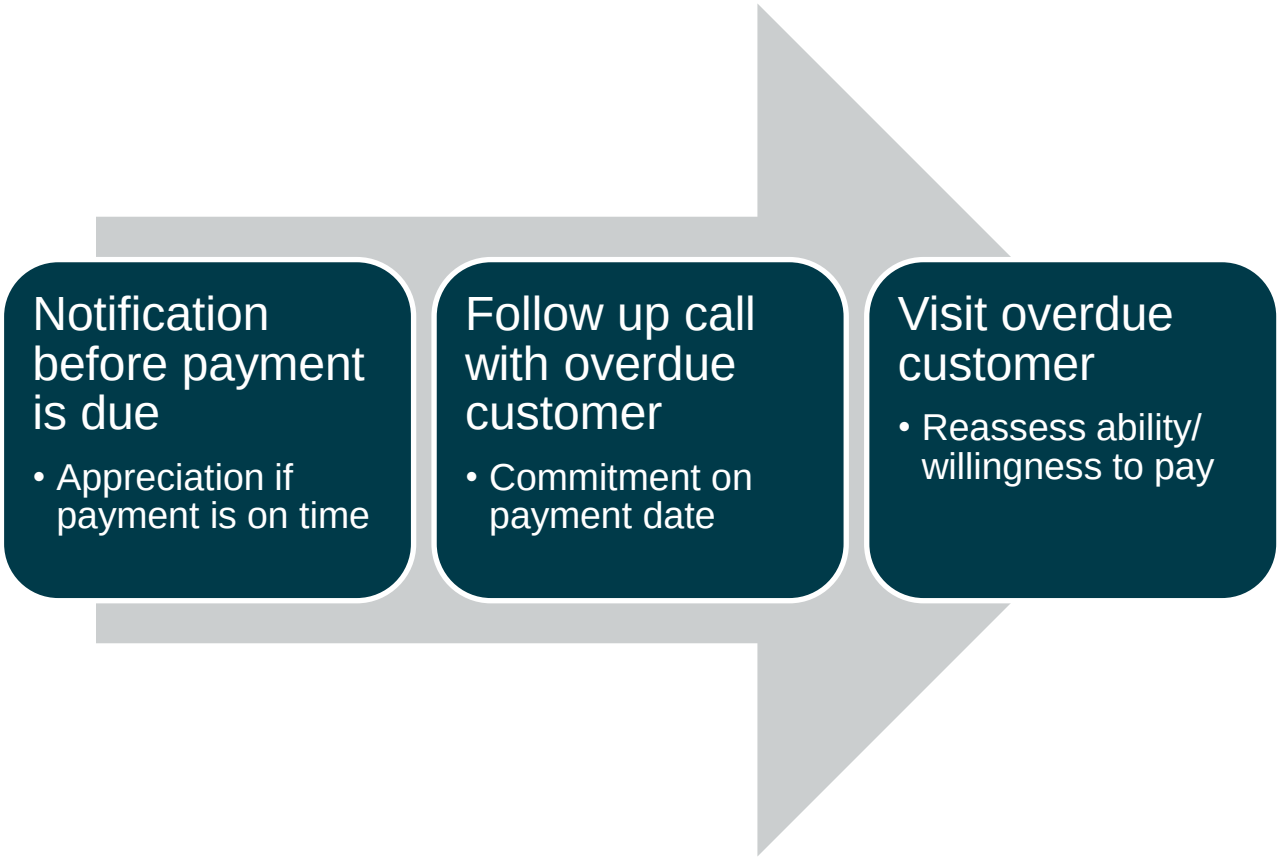
Credit monitoring cycle



Collections

Collections start with effective credit assessment

Typical collections flowchart

Tools to ease collections

1. Device lock-out
2. Witholding future financial services
3. Reporting default to credit bureaus
4. Repossession of asset
5. Legal recourse

Repossession and Resale

1. Existence of policies and procedures
2. Signaling effect of repossession
3. Tracking post-default cashflows
4. Repossession of asset. Useful for
    i. Repossession rates
    ii. Salvage and resale values
    iii. LGD calculation

COLLECTIONS

Framework for best practice

Arrears Management

Pre-disbursement	Post-disbursement
Policies / Processes	
Limits	Monitoring
Loan Analysis	Early-warning
Decision-making	Pressure
Loan covenants	
Collateral / Co-debtors	
	Restructuring
	Outsourcing
	Legal actions

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Customer Protection

Poll Question #3:
What is your approach to repossession?

1. *We only repossess when it is economical. The unit has to have residual value and be easily accessible.*

2. *We repossess whenever economical, as well as occasionally to send a signal.*

3. *Customers can return our assets, but we will never repossess them.*

How have your repossession practices evolved over the years?

Time for a 15-minute Break

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PORTFOLIO MANAGEMENT

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EXPECTED LOSS

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Expected and Unexpected Loss

The basis for accounting for credit losses

Expected Loss (EL) = PD * LGD * EAD

- PD = Probability of Default, % per annum
- LGD = Loss Given Default, %
- EAD = Exposure at Default, currency units

Unexpected Loss

= annual portfolio credit loss amount in excess of the average expected loss.

- Correlation of borrowers' economic situation (concentrations)
- External events (macroeconomic crisis, currency devaluation, natural disasters, …)
- Need to budget exposure by geography and market segment (ex-ante diversification)

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Expected and Unexpected Loss

Calculating Expected Loss

12-month Transition matrix

Outstand.	12m	Settled	Zero	1 to 30	31 to 60	61 to 90	...	> 180	> 90 days
8,500,000	**Zero**	48.48%	49.84%	0.31%	0.16%	0.15%		0.05%	1.06%
8,300,000	**1 to 30**	24.29%	16.98%	0.18%	0.14%	0.21%		21.93%	58.20%
1,200,000	**31 to 60**	11.56%	3.18%	0.05%	0.04%	0.07%		61.15%	85.09%
300,000	**61 to 90**	7.49%	0.11%	0.00%	0.00%	0.00%		85.27%	92.39%
100,000	**91 to 120**	7.43%	-	-	-	-		91.01%	92.57%
20,000	**121 to 150**	8.47%	-	-	-	-		90.81%	91.53%
40,000	**151 to 180**	9.39%	-	-	-	-		90.19%	90.61%
470,000	**> 180**	10.05%	-	-	-	-		89.64%	89.95%

What is the Expected Loss on this portfolio on 31/12/2019? Make a reasonable LGD assumption based on your market experience.

= 6,788,835 x LGD

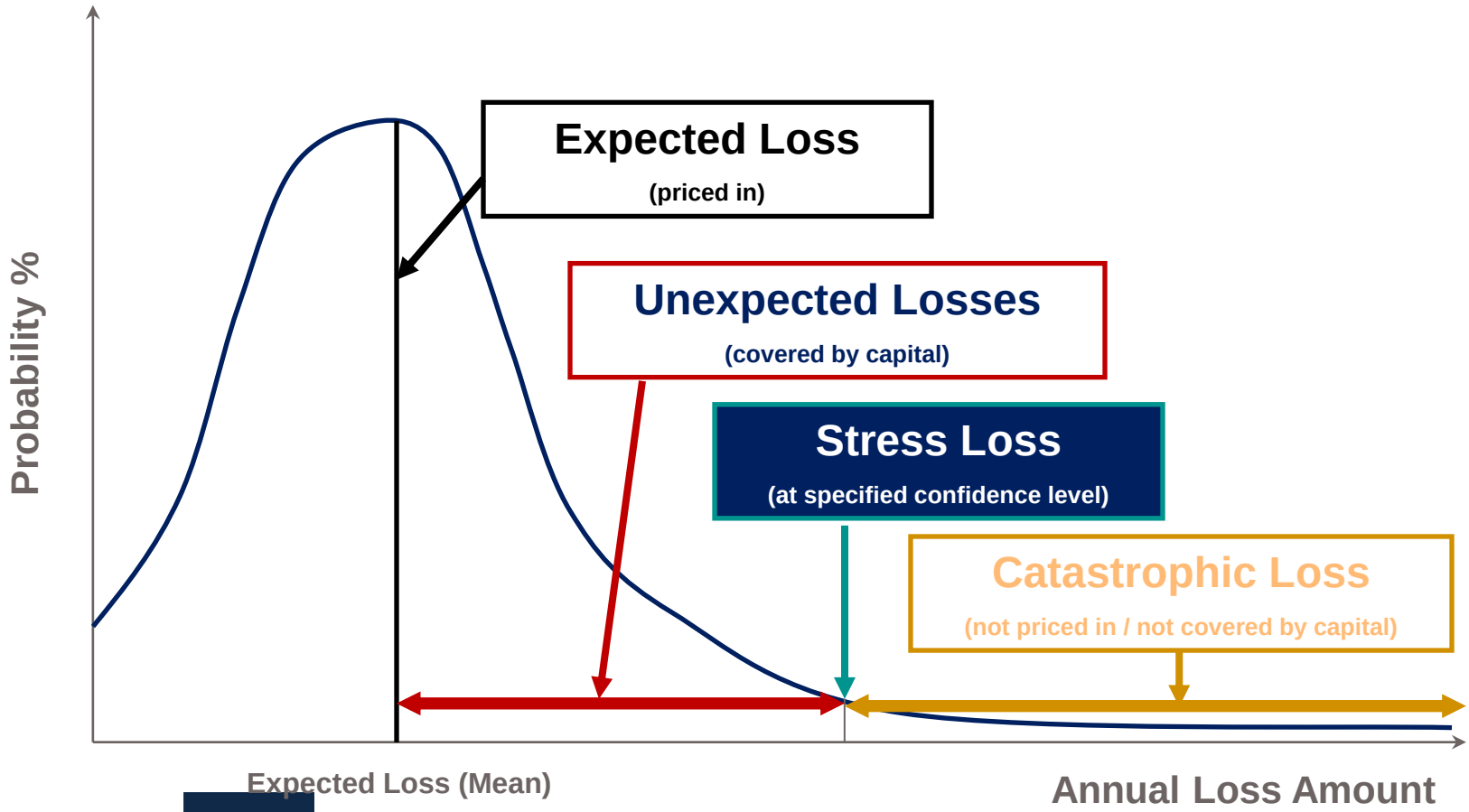
Pricing in Expected Loss

Expected Loss (EL) = PD * LGD * EAD

- Refers to amount the entity can expect to lose under ordinary business conditions
- IFRS 9 requires initial recognition upon disbursement
- This amount should be priced into lease contract
- An entity with high PD, should strive to minimize LGD and EAD
  - Robust collections/ recovery processes to lower LGD
  - Minimize fraudulent cases to decrease EAD
  - Frequent monitoring of portfolio to identify problem loans early

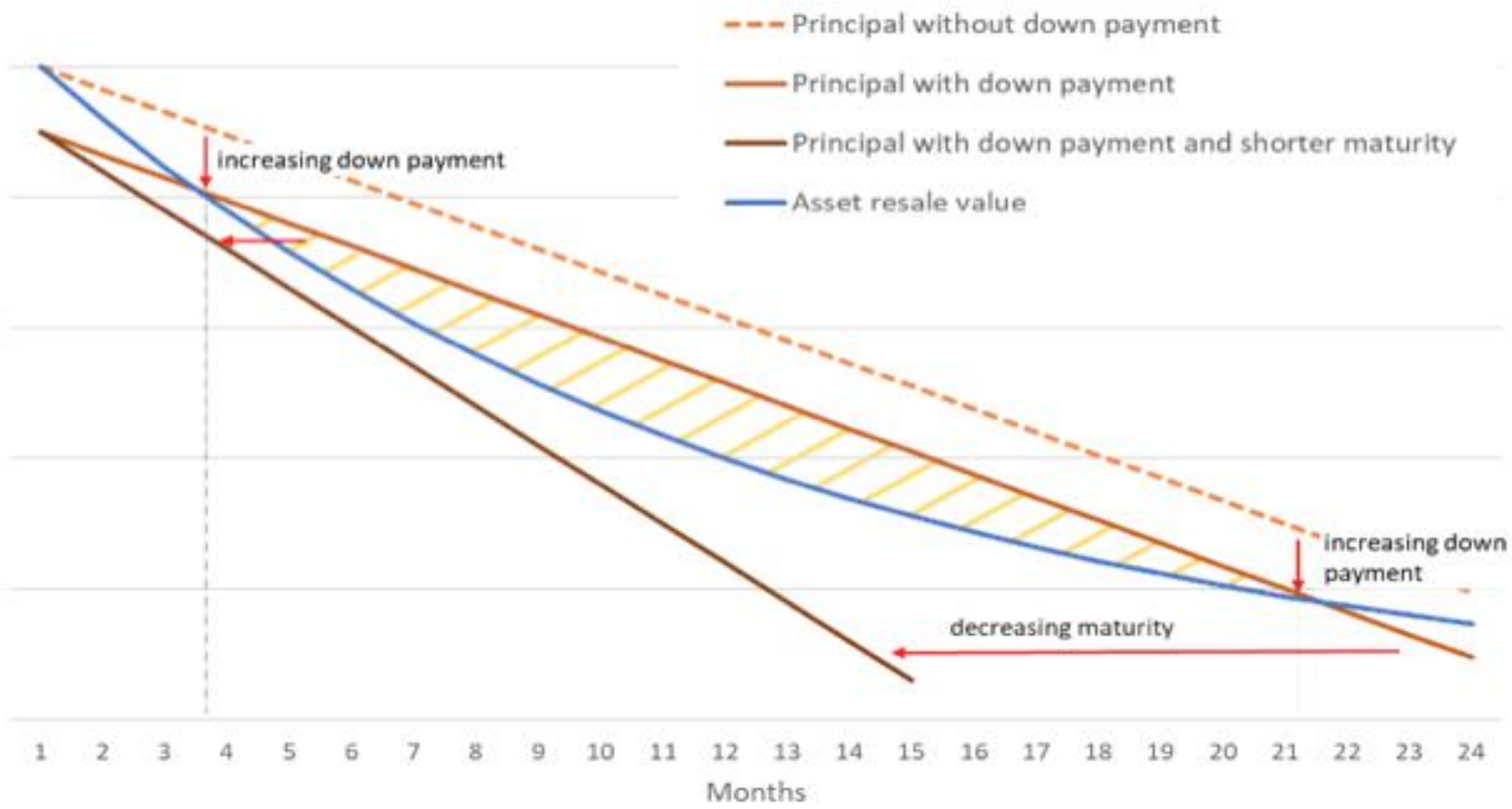
Expected and Unexpected Loss

Theoretical Annual Loss Distribution in a Credit Portfolio



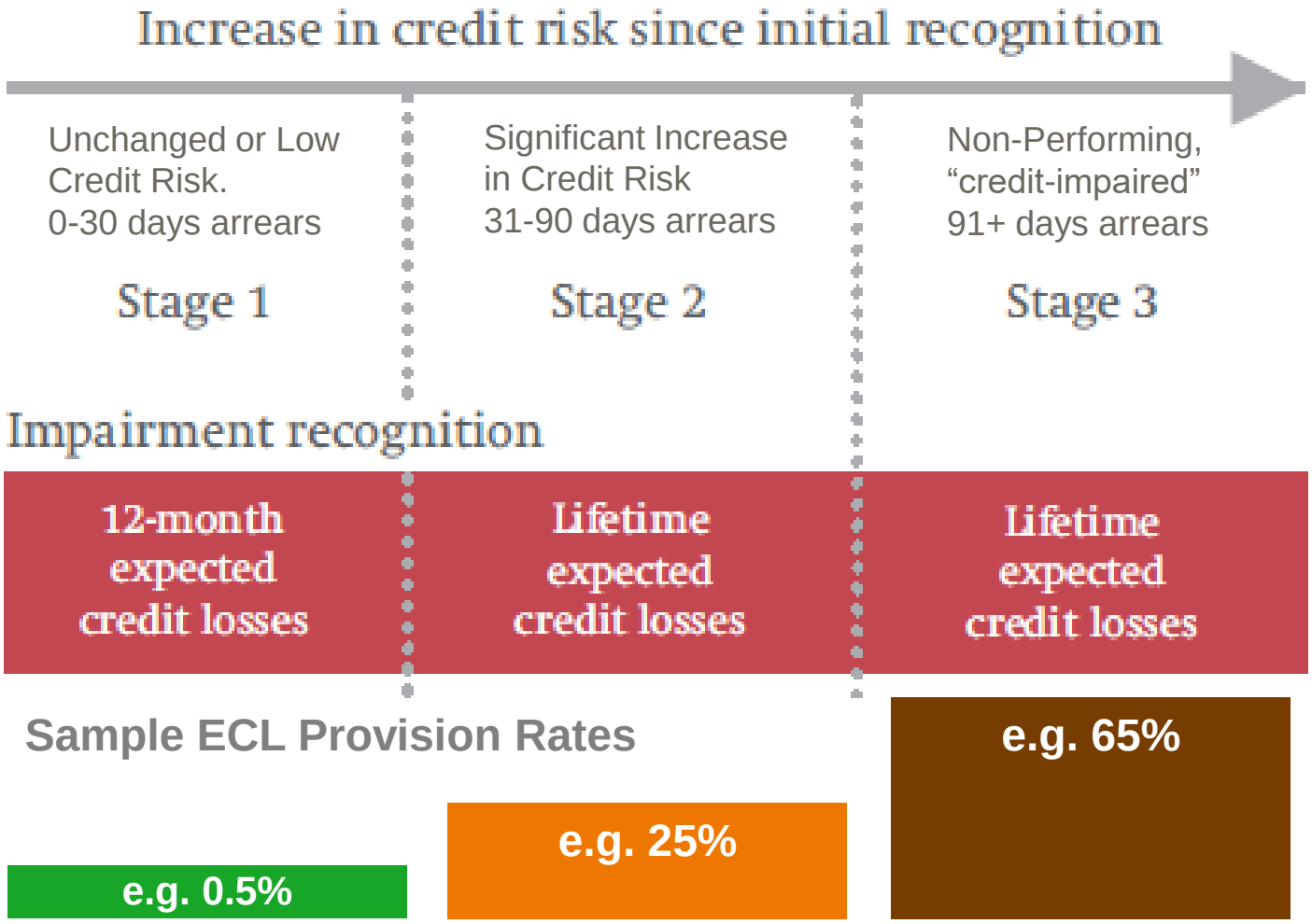
Expected and Unexpected Loss

Shorten maturities to minimize Unexpected Loss



IFRS 9: Impairment basics

The 3-Stage Model for IFRS 9 Impairments



Poll Question #4:
How do you provision for loan losses?

1. *We don't provision anything at all, we use a different accounting framework.*

2. *We provision for some loss on an annual basis. It may not be sufficient.*

3. *We provision on a regular basis and try to update our EL frequently, but it's a challenge.*

4. *We update our EL on a product and segment basis automatically, and provision upfront for every customer in close to real-time.*

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Guest Speaker

Alison Boess

Head of Credit Operations

ENGIE Energy Access

PORTFOLIO METRICS AND ANALYSIS

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Guest Speaker

Nicky Khaki

Senior Financial Sector Specialist

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Portfolio at Risk

A basic measure for portfolio quality

Portfolio at risk measures a lender's credit risk position at a specific point in time (X days). Usu. Tracked for 1,7, 30 and 90 day arrears

$$PaR\_X(\%) = \frac{Principal\ outstanding > X\ days + principal\ written\ off\ (over\ last\ YEAR)}{Total\ gross\ portfolio\ outstanding}$$

PAR 1-day	PAR 30-day	PAR 90-day
• Usu. smaller value assets • Field officer level tracking	• Assets <$20,000 • At branch/ HQ level	• Assets >$20,000 • LArger SMEs/ Corporates

Receivables at Risk

A basic measure for portfolio quality *where repayments are flexible*

	1	2	3	4	5	6	7	8	9	10	Collections Rate
Customer #1	$		$	$	$	$		$	$		70%
Customer #2	$							$			20%
Customer #3	$			$			$			$	40%
Customer #4	$		$	$	$	$	$	$	$	$	90%

- Using PAR would flag all clients by Month 5
- Customers with high collections rate may not be risky

Receivables at Risk (RAR) an asset finance company to identify receivables that are owed by clients who are paying too infrequently, but may still be paying

$$RaR(\%) = \frac{Remaining\ Value\ of\ Outst.\ Receivables\ for\ Which\ Overall\ Collection\ Rate < [X]\% + write\ offs}{Value\ of\ Total\ Future\ Receivables\ Due}$$

Vintage curves

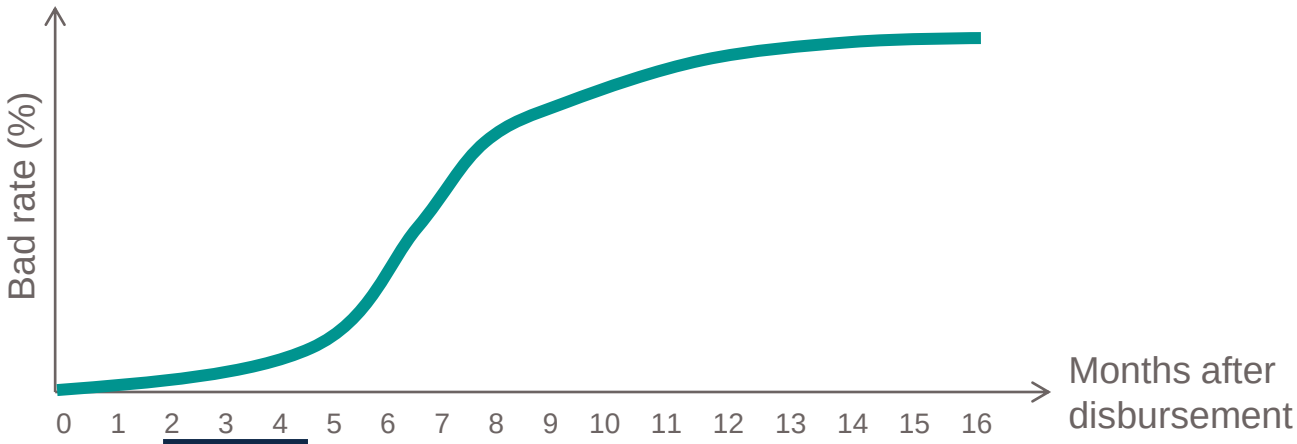
Default is a function of time

Address fundamental weakness of PAR/RAR measures

$$Bad\ Rate_t = \frac{\text{"Bad"}\ Principal_t + Written\_off\ Principal_{T0\ until\ t}}{Disbursed\ Amount_{T0}}$$

How a typical vintage curve might look like?

(e.g. for all loans disbursed in January 2017)



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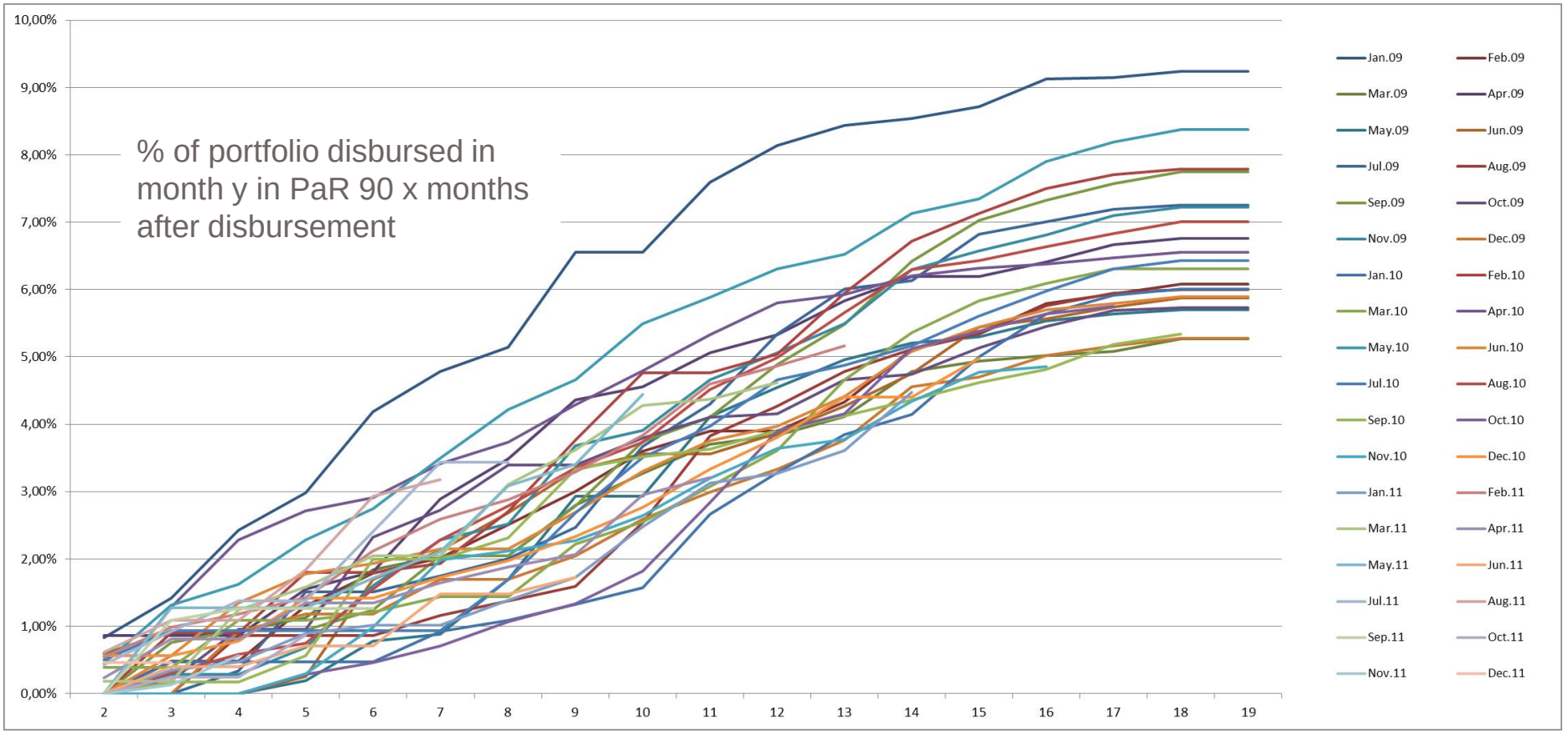
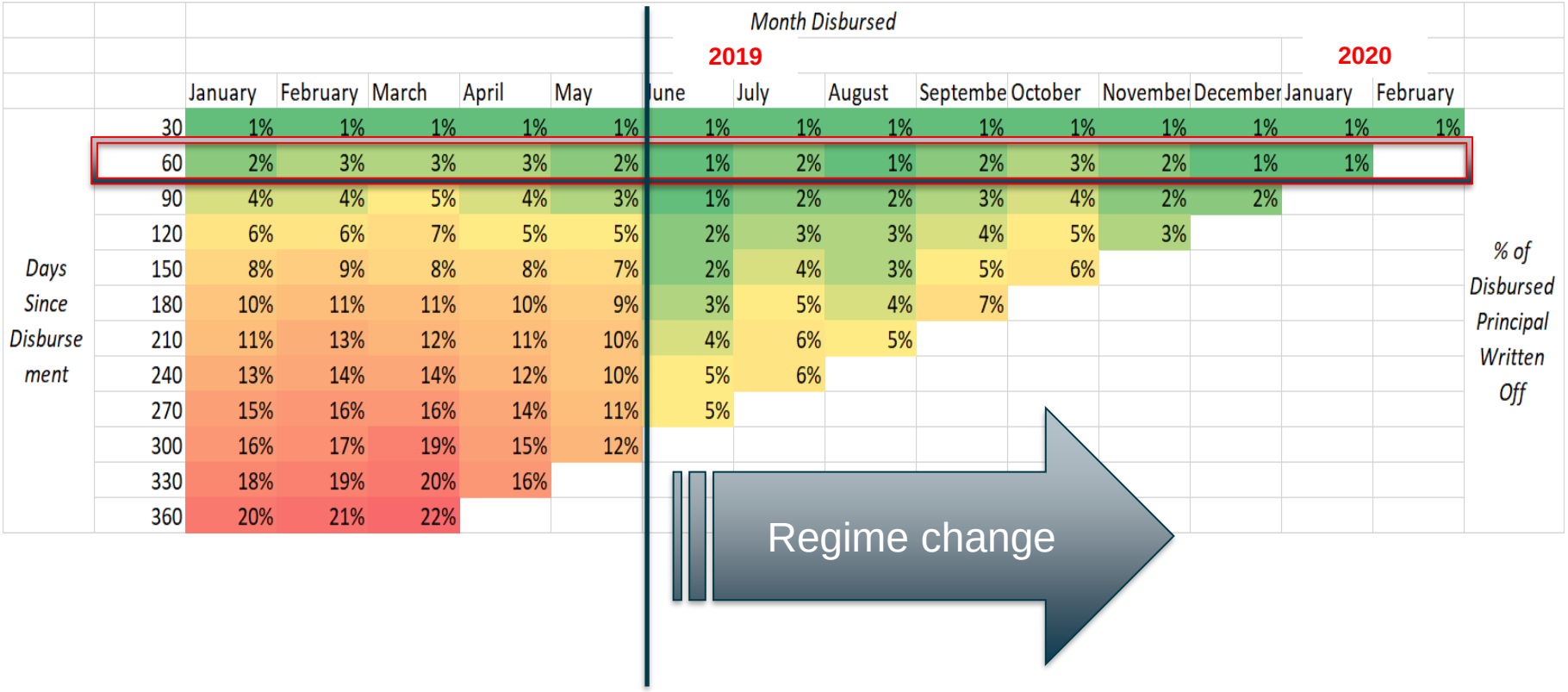
Vintage curves

Shorter curves should plot below the older ones for a given period



Vintage curves

The same concept may be numerically expressed



Portfolio metrics

Vintage Curves vs. Portfolio at Risk/ Receivables at Risk

- Portfolio at Risk is a lagging indicator of borrower performance.
- In rapidly growing portfolios, PaR may seriously underestimate the bad rate.
- New loans always perform well. It takes a while for borrowers to fall into arrears. Even the worst borrowers should manage to pay a few installments with the money they just borrowed …
- If there are always more new loans than older loans because the portfolio is growing rapidly, then it is no surprise that the PaR will be excellent.
- When portfolio growth slows or turns negative, the PaR goes up.
- Vintage curves can serve as a leading indicator:
  - i.e. an early warning of emerging negative portfolio trends in a disbursement boom, but also …
  - as a visualization of improving performance in newer loan generations.

Transition matrix

- Client repayment behaviour evolves over a loan tenor. Clients who used to pay on time may deteriorate and vice versa
- Transition matrix captures this repayment behavior in a tabular manner, showing how a portfolio in a given month evolved in the subsequent month
- It is useful in guiding and tracking the effectiveness of monitoring, collections, and recovery activities
- May be used in calculating Expected Loss of a portfolio

Transition Matrix	Status Month End x+1 ->														Empirical Default
Month End x	Settled	Current	1-30 d	31-60d	61-90d	91-120d	121-150d	151-180 d	181-210d	211-240d	241-270d	271-300d	301-330d	≥ 331-360d	Rate
Current	8.02%	91.68%	**0.30%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%
1 - 30 d	3.74%	13.91%	36.17%	**46.16%**	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	44.67%
31 - 60 d	2.99%	0.00%	9.54%	35.22%	**52.25%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	71.49%
61 - 90 d	2.74%	0.05%	0.60%	4.69%	35.53%	**54.82%**	0.00%	0.63%	0.00%	0.00%	0.00%	0.00%	0.00%	0.95%	85.28%
91 - 120 d	2.40%	0.00%	0.00%	0.00%	4.13%	24.55%	**68.92%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	89.72%
121 - 150 d	1.48%	0.00%	0.03%	0.00%	0.00%	2.21%	23.00%	**73.28%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	90.40%
151 - 180 d	1.29%	0.00%	0.00%	0.00%	0.00%	0.00%	4.14%	15.47%	**76.76%**	1.24%	0.00%	0.00%	0.00%	1.09%	90.80%
181 - 210 d	0.87%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.59%	12.53%	**83.01%**	0.00%	0.00%	0.00%	0.00%	91.77%
211 - 240 d	0.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.06%	**97.61%**	0.00%	0.00%	0.00%	92.71%
241 - 270 d	5.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.30%	**93.00%**	0.00%	0.00%	93.02%
271 - 300 d	1.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.39%	**83.53%**	0.00%	98.72%
301 - 330 d	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	100.00%
331 - 360 d	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	100.00%

Transition matrix

Getting the Matrix

Loan	March		April	
	E	Arrears	E	Arrears
A	10,000	0	9,000	0
B	6,000	12	6,000	42
C	7,000	18	7,000	48
D	10,000	65	8,000	0
E	2,000	0	repaid	-
F	6,000	0	5,000	0
G	8,000	75	8,000	105
H	8,000	100	8,000	130
SUM	57,000		51,000	

E = outstanding loan volume, arrears = days overdue

Transition matrix

Getting the Matrix

Mar / Apr	Settled	Current	1-30d	31-60d	61-90d	91+d	SUM
Current							
1-30d							
31-60d							
61-90d							
91+d							
SUM							

Transition matrix

Getting the Matrix

Mar / Apr	Settled	Current	1-30d	31-60d	61-90d	91+d	SUM
Current	1,000	9,000					
1-30d							
31-60d							
61-90d							
91+d							
SUM							

	E	Arrears	E	Arrears
A	10,000	0	9,000	0
B	6,000	12	6,000	42
C	7,000	18	7,000	48

Transition matrix

Getting the Matrix

Mar / Apr	Settled	Current	1-30d	31-60d	61-90d	91+d	SUM
Current	4,000	14,000					**18,000**
1-30d				13,000			**13,000**
31-60d							**0**
61-90d	2,000	8,000				8,000	**18,000**
91+d						8,000	**8,000**
SUM	**6,000**	**22,000**	**0**	**13,000**	**0**	**16,000**	**57,000**

Transition matrix

Getting the Matrix

Mar / Apr	Settled	Current	1-30d	31-60d	61-90d	91+d	SUM
Current	22.2%	77.8%					**100%**
1-30d				100%			**100%**
31-60d							**-**
61-90d	11.1%	44.4%				44.4%	**100%**
91+d						100%	**100%**

Transition matrix

Forecasting arrears…

End of July your existing portfolio is UGX 20,000,000. 80% thereof is in current status while 5% is in arrears between 1 and 30 days. An additional 500,000 is in arrears between 31 and 60 days and finally again 500,000 is in arrears between 61 and 90 days.

a) Which amount do you expect to be in arrears 1-30 days end of August?

b) Which amount do you expect to be in arrears 1-30 days end of September?

Transition Matrix	Status Month End x+1 ->													
Month End x	Settled	Current	1-30 d	31-60d	61-90d	91-120d	121-150d	151-1						
Current	8.02%	91.68%	**0.30%**	0.00%	0.00%	0.00%	0.00%	0						
1 - 30 d	3.74%	13.91%	36.17%	**46.16%**	0.02%	0.00%	0.00%	0						
31 - 60 d	2.99%	0.00%	9.54%	35.22%	**52.25%**	0.00%	0.00%	0						
61 - 90 d	2.74%	0.05%	0.60%	4.69%	35.53%	**54.82%**	0.00%	0						
91 - 120 d	2.40%	0.00%	0.00%	0.00%	4.13%	24.55%	**68.92%**	0						
121 - 150 d	1.48%	0.00%	0.00%	0.00%	0.00%	2.21%	23.00%	73						
151 - 180 d	1.29%	0.00%	0.00%	0.00%	0.00%	0.00%	4.14%	15.47%	**76.76%**	1.24%	0.00%	0.00%	0.00%	1.09%
181 - 210 d	0.87%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.59%	12.53%	**83.01%**	0.00%	0.00%	0.00%	0.00%
211 - 240 d	0.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.06%	**97.61%**	0.00%	0.00%	0.00%
241 - 270 d	5.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.30%	**93.00%**	0.00%	0.00%
271 - 300 d	1.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.39%	**83.53%**	0.00%
301 - 330 d	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**
331 - 360 d	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**

$$
\begin{aligned}
& 0.30\% * 20{,}000{,}000 * 80\% \\
+\ & 36.17\% * 20{,}000{,}000 * 5\% \\
+\ & 9.54\% * 500{,}000 \\
+\ & 0.60\% * 500{,}000 \\
=\ & \underline{460{,}400}
\end{aligned}
$$

Transition matrix

The Power of the Matrix! - What to look at:

- Month by month elementary transitions for the total portfolio, by segment.
- Rolling x-month average monthly matrix for total portfolio or by segment.
- N^{th} exponential =MMULT{} providing a n-month forward portfolio status, using either an average monthly matrix or just the most recent 1-month matrix.
  → Martrix rules: $M^n * M^m = M^{n+m}$
- Seasonalized matrix forecast – concatenating prior calendar month matrixes.

Transition Matrix Exponential	Status +6 months ->													Empirical Default Rate +6m
Starting Status	Settled	Current	1-30 d	31-60d	61-90d	91-120d	121-150d	151-180 d	181-210d	211-240d	241-270d	271-300d	301-330d	331-360d	
Current	39.31%	59.60%	**0.36%**	0.29%	0.22%	0.13%	0.07%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%
1 - 30 d	20.93%	16.82%	2.19%	**5.19%**	10.20%	12.32%	14.39%	11.49%	5.28%	0.22%	0.10%	0.00%	0.00%	0.89%	44.67%
31 - 60 d	14.57%	2.94%	1.21%	3.03%	**6.77%**	9.66%	15.29%	18.23%	16.39%	9.63%	0.39%	0.19%	0.00%	1.71%	71.49%
61 - 90 d	11.30%	0.43%	0.28%	0.73%	1.97%	**3.52%**	7.98%	13.66%	18.70%	20.31%	17.72%	0.61%	0.31%	2.46%	85.28%
91 - 120 d	9.86%	0.03%	0.03%	0.08%	0.27%	0.63%	**2.17%**	5.23%	9.82%	15.38%	25.04%	29.69%	0.47%	1.30%	89.72%
121 - 150 d	9.55%	0.01%	0.00%	0.01%	0.03%	0.08%	0.42%	**1.31%**	2.99%	5.69%	12.27%	29.80%	35.80%	2.04%	90.40%
151 - 180 d	9.20%	0.00%	0.00%	0.00%	0.00%	0.01%	0.07%	0.26%	**0.65%**	1.33%	3.19%	11.59%	22.72%	50.98%	90.80%
181 - 210 d	8.23%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.03%	0.08%	**0.17%**	0.44%	2.24%	6.09%	82.72%	91.77%
211 - 240 d	7.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**0.00%**	0.06%	0.35%	92.30%	92.71%
241 - 270 d	6.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**0.01%**	0.05%	92.96%	93.02%
271 - 300 d	1.28%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**0.01%**	98.71%	98.72%
301 - 330 d	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	100.00%
331 - 360 d	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**100.00%**	100.00%

Recovery Analysis

- Refers to funds collected after default
- Net Present Value of recoveries are used to determine Loss Given Default (LGD)

  LGD = 1 – Recovery ratio

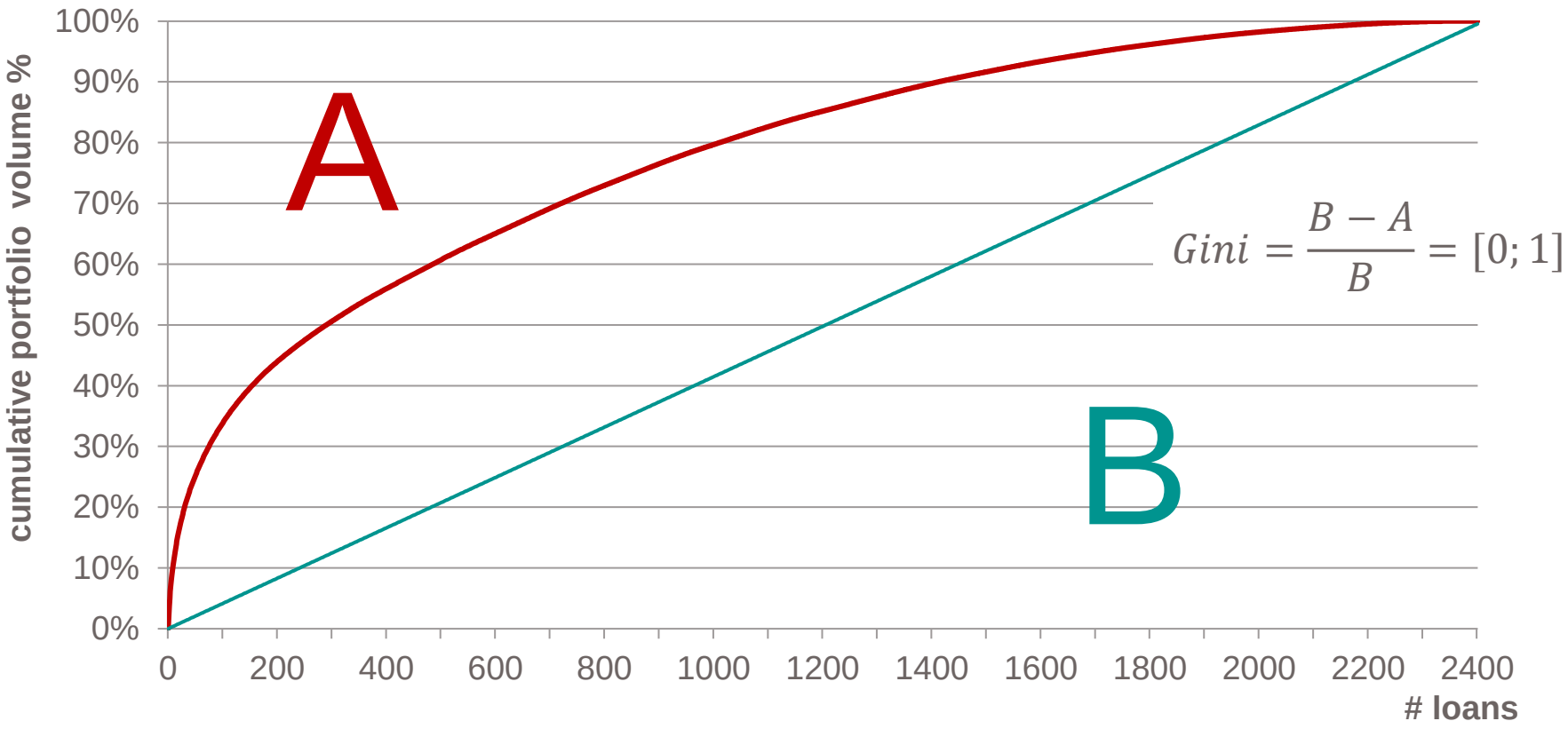
  Where recovery ratio is the proportion of recovery to the default amount. Discount factors are determined using the effective interest rate
- Recoveries are usually higher when there is collateral in place. This has implications for
  - Timing of repossessions (the earlier the better)
  - KYC – knowing where the asset is deployed
  - Impairment provisions – the higher the recoveries, the lower the provisions (using Expected Loss/ IFRS 9)

Portfolio concentration

- By which categories a loan portfolio can be concentrated?
  - Regions (geographical)
  - Industries (sectoral)
  - Loan amounts
  - Loan products
  - Currency
  - Loan maturities → liquidity risk?
  - …

Portfolio concentration

Gini Coefficient – a basic measure of concentration



→ **The closer Gini is to 1, the higher the concentration!**

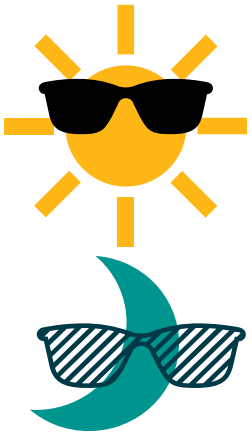
Portfolio concentration

Effective Portfolio Diversification

- Sector / activity diversification is often too superficial in low income finance.
- Effective diversification in housing, consumer, SME credit etc. always requires a strong **geographical element.**

	Retail Trade	Artisanal Production	Agriculture	Personal Services	Construction
Region 1	7%	2%	3%	5%	6%
Region 2	10%	2%	0%	5%	5%
Region 3	3%	5%	0%	1%	1%
Region 4	4%	2%	6%	3%	4%
Region 5	5%	4%	13%	2%	2%

Case Studies!



Company	Analysts	Executives
SolarSun	Breakout Room 1 (Walter)	Breakout Room 2 (Rebecca)
SunMoon	Breakout Room 3 (Dan)	Breakout Room 4 (Roan)
Your Task is to Answer:	- *What is the health of the portfolio?* - *How does it align with Appetite?* - *What is the trend?*	- *What additional information do you need?* - *What actions do you recommend to the board?*

15 minutes to discuss
2 minutes to present (that's it!)

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PORTFOLIO MANAGEMENT

KRIs, KPIs and DASHBOARDS

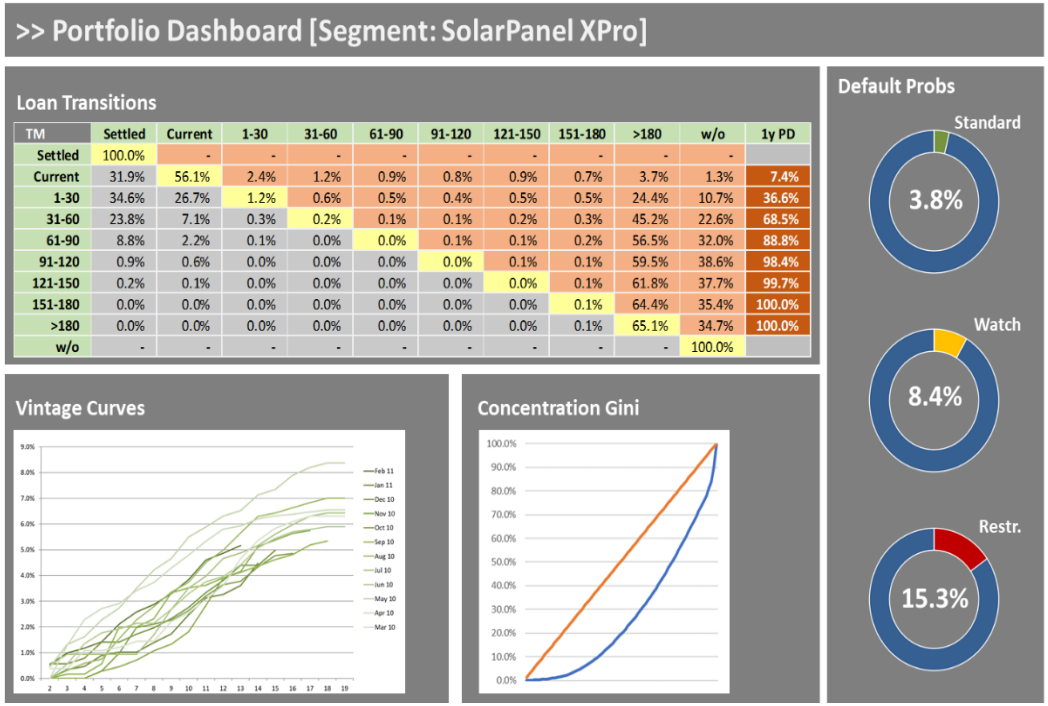
CGAP GOGLA

Poll Question #5:
How often do you monitor your portfolio?

1. *Hourly*
2. *Daily*
3. *Weekly*
4. *Monthly*
5. *Quarterly*

KRIs, KPIs and Dashboards

- An entity should develop a set of indicators to track all risk categories
- All indicators should have targets and/or limits to guide decision-making
- Regular reporting and tracking of key indicators
  - Daily for credit and liquidity risk
  - Monthly for other risk categories



TM	Settled	Current	1-30	31-60	61-90	91-120	121-150	151-180	>180	w/o	1y PD
Settled	100.0%	-	-	-	-	-	-	-	-	-	
Current	31.9%	56.1%	2.4%	1.2%	0.9%	0.8%	0.9%	0.7%	3.7%	1.3%	7.4%
1-30	34.6%	26.7%	1.2%	0.6%	0.5%	0.4%	0.5%	0.5%	24.4%	10.7%	36.6%
31-60	23.8%	7.1%	0.3%	0.2%	0.1%	0.1%	0.2%	0.3%	45.2%	22.6%	68.5%
61-90	8.8%	2.2%	0.1%	0.0%	0.0%	0.1%	0.1%	0.2%	56.5%	32.0%	88.8%
91-120	0.9%	0.6%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	59.5%	38.6%	98.4%
121-150	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	61.8%	37.7%	99.7%
151-180	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	64.4%	35.4%	100.0%
>180	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	65.1%	34.7%	100.0%
w/o	-	-	-	-	-	-	-	-	-	100.0%	

Guest Speakers

Jonathan Saunders

COO

SunCulture

Dr. Joachim Bald

Practice Leader – Risk Management

Frankfurt School of
Finance and Management

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Thank you

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