

# Usage of EWS model for cross-sale purpose

Dmytro Kolechko, CRO of Vietnam Prosperity Bank

# Using EWS model for cross-sale purposes

When there is not enough time or luck of recourse to build separate model for cross-sale purposes, but having EWS models in place, it is proposed to use EWS model for cross-sale purposes and to make the research about efficiency of such a use.

✓ **EWS in place**

✓ **Lack of resources**



**to use EWS model for cross-sale purposes?**

**Maximum profitability of existing customers** is a very important question for all banks, since they have **lower risk** and **smaller costs** in comparison to new customers. The most popular approach is pre-approved program, for example: cross-sell, top-up and renewal limit.



**Existing customers**



**Good customers**



**Top-up, cross-sell, renewal**

# Definition change

Performance of EWS model was tested for different definition of bad customer and longer outcome period for purposes of cross-sale:

## EWS used for Pre-Collection

### Outcome period

2 months

### Bad definition

14+ DPD

### *Change definition:*

- *Longer outcome period*
- *More deep delinquency*

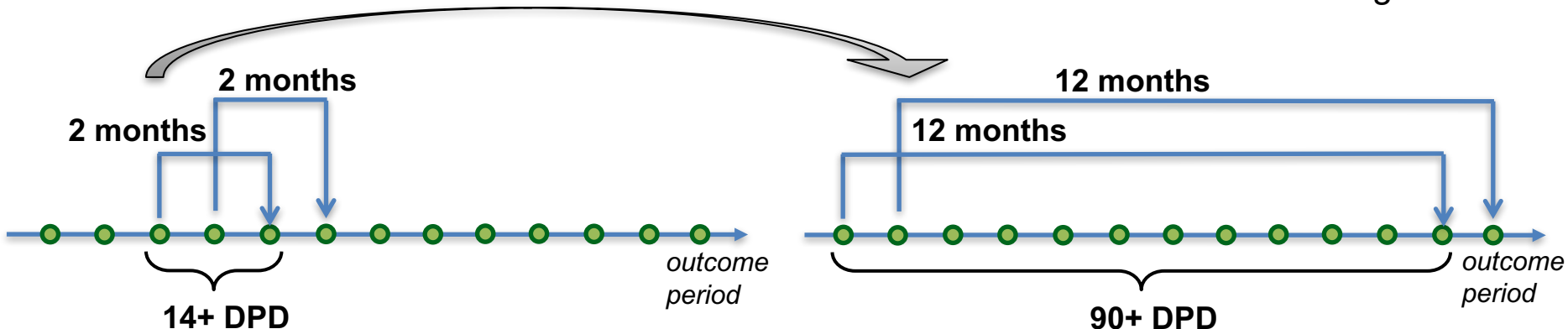
## EWS used for Cross-sale

### Outcome period

12 months for Retail +  
restructure  
9 months for SME

### Bad definition

90+ DPD for Retail  
90+ DPD + restructuring for SME

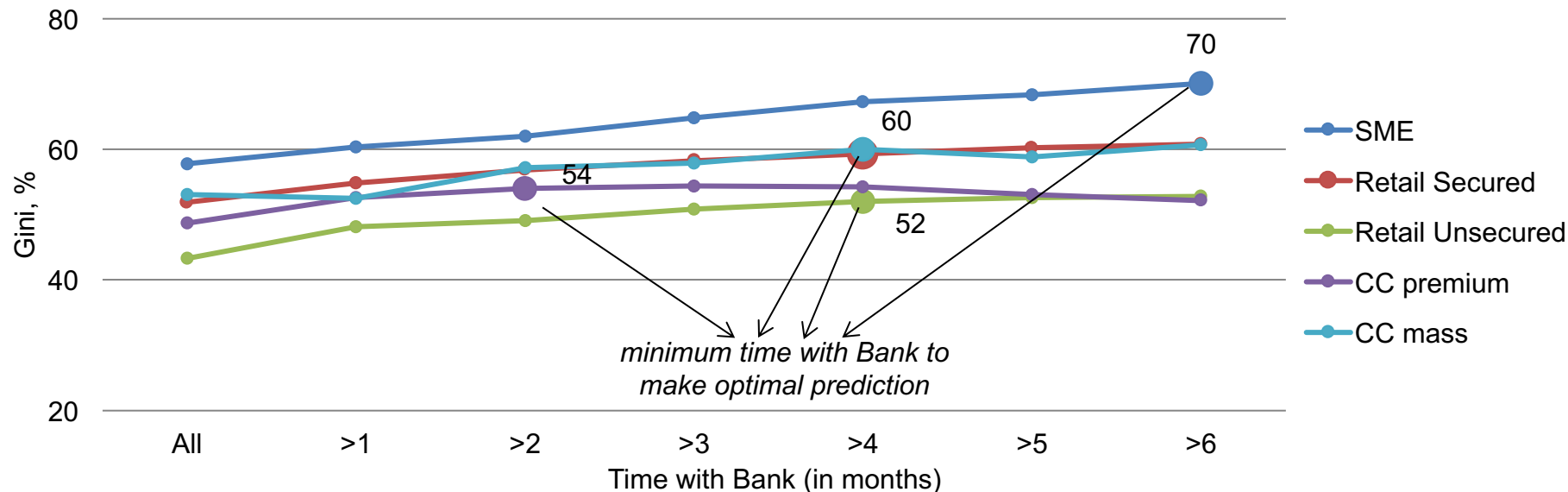


Same condition, to get into the sample: 0 DPD at observation date.

# When model can be applied?

Defining optimal time for model usage, originally build **EWS models were tested on 5 different segments** of customers with new bad definition, suitable for **Cross-sale purposes**. Gini coefficient was calculated depending on **time of customer's relationship with the Bank** (from 1 to 6 months), in order to find out the minimum time needed to make optimal prediction:

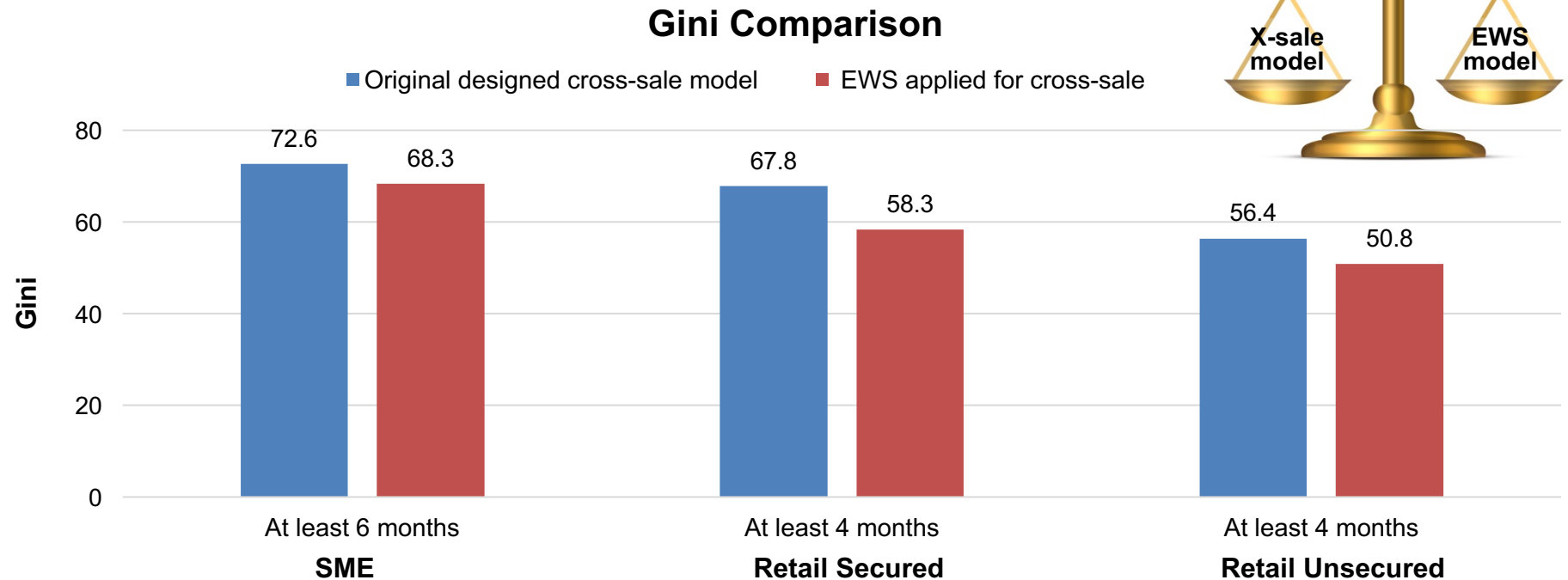
**Gini vs. time with Bank**



- ✓ As we may see from the graph, **Gini indicates pretty strong predictive power of EWS models, when applied for Cross-sale definition.**
- ✓ **Minimum time needed to make optimal prediction depend on the customer segment** (from 2 months for mass CC customers segment up to 6 months for SME customers segment).

# Comparison of EWS and Cross-sale models

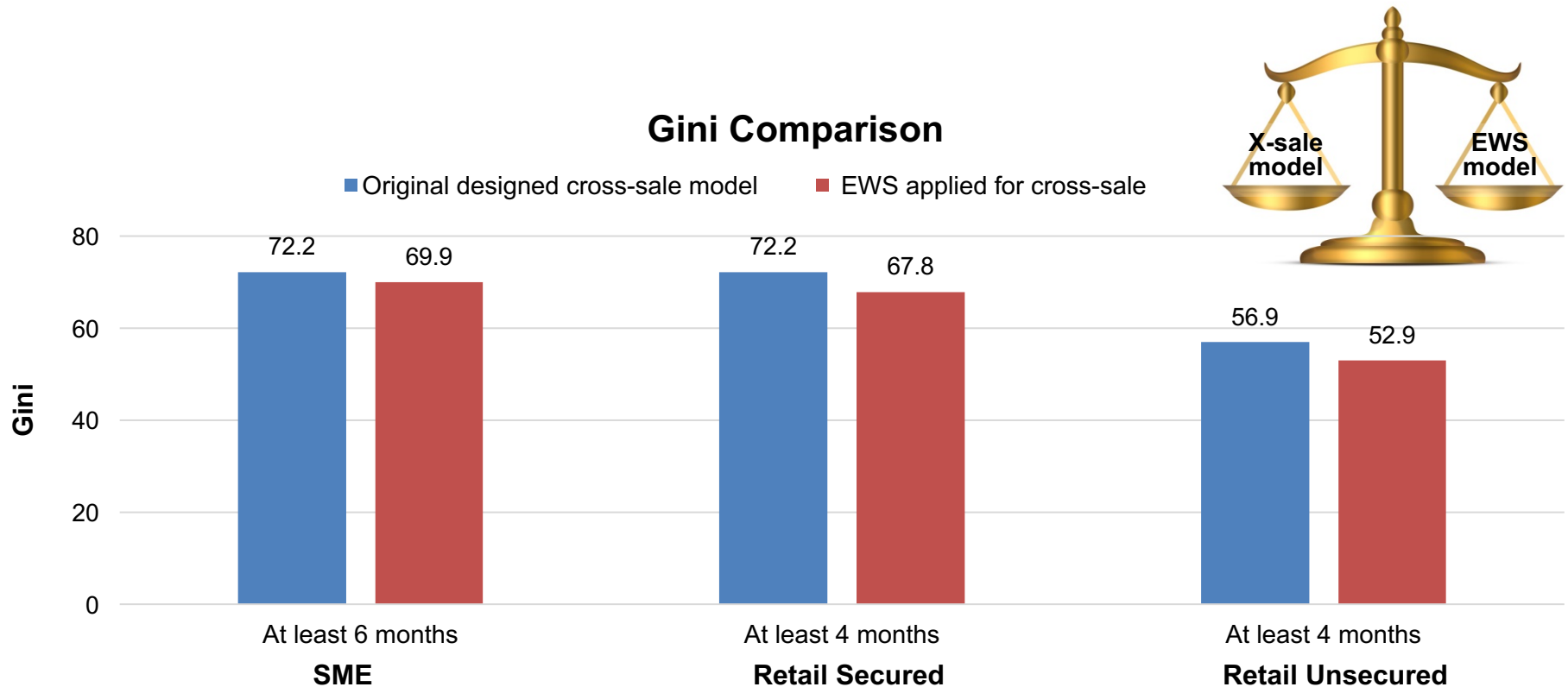
Here is a comparison of predictive power of EWS models applied for cross-sale customers (using most optimal time with Bank) and later originally built cross-sale models on development samples of X-sale models:



Originally built cross-sale models have higher Gini, but the difference with EWS models usage is not very big.

# Comparison of EWS and Cross-sale models

Similarly, here is a comparison on the out-of-time sample for both models (data is taken as of end of 2015):



Originally built cross-sale models have higher Gini on development sample and out-of-time sample, but the difference with EWS models usage is not very big, thus we can make conclusion about expediency of EWS usage for cross-sale purposes in the circumstances of lack of time and recourses for fast model development.

# Comparison of EWS and Cross-sale models

Moreover, hypothesis that the model, build for X-sale will also work for EWS, appeared to be true. Here is the result of Cross-sale model applied to EWS purpose (sample as of end of Oct 2016, outcome: 2 months, Bad: 14+ DPD):



**Cross sale model works well for EWS definition except retail unsecured. The reason could be:**

- Variables in cross-sale model is more diversified than in EWS model because development sample of cross-sale model is more complex and experience of scoremaker increase in time.
- Repayment behavior of Retail secured and SME customer is more stable than Retail unsecured customer.

# Models profitability rough estimation

**In order to make some rough estimation and comparison of models profitability, the following assumptions were done:**

- Number of low-risk customers and medium-risk customers who accepted top-up proposition are equal. Top-up amount depends on risk level.
- Exposure at default is equal to 50% of disbursement.

## Bank's Profit calculation:

The following calculation is the simplest way to calculate the profit before tax of bank based on estimation of income and loss of portfolio.

$$\text{Profit} = \text{Income} - \text{Loss}$$

### Notions:

- N: number of customers in each risk level (low and medium) who accepted top-up proposition,
- $PD_{EWS}^{Low}$ : probability of default of low-risk customers defined by EWS model; similar notions were used for other risk level of EWS and cross-sale model.
- A: Small amount proposed to medium risk customers,
- B: Bigger amount proposed to low risk customers,
- p: segment's income (in term of loan amount).

Total amount disbursed are the same for the two models:

$$\text{Disb} = N \times A + N \times B.$$

Income given by EWS model is:

Income(EWS) =

$$N \times A \times (1 - PD_{EWS}^{Med}) \times p + N \times B \times (1 - PD_{EWS}^{Med}) \times p.$$

Loss given by EWS model is:

Loss(EWS) =

$$N \times A \times 50\% \times PD_{EWS}^{Med} + N \times B \times 50\% \times PD_{EWS}^{Med}.$$

Profit given by EWS model:

Profit (EWS) = Income(EWS) - Loss(EWS)

$$= N \times A \times \left( (1 - PD_{EWS}^{Med}) \times p - 50\% \times PD_{EWS}^{Med} \right) + N \times B \times \left( (1 - PD_{EWS}^{Low}) \times p - 50\% \times PD_{EWS}^{Low} \right).$$

Similarly, profit given by Cross-sale model is:

Profit (Cross) =

$$N \times A \times \left( (1 - PD_{Cross}^{Med}) \times p - 50\% \times PD_{Cross}^{Med} \right) + N \times B \times \left( (1 - PD_{Cross}^{Low}) \times p - 50\% \times PD_{Cross}^{Low} \right).$$

We take different between two amounts:

$\Delta_{Profit} = \text{Profit}(\text{Cross}) - \text{Profit}(\text{EWS}) =$

$$N \times A \times \left( (PD_{EWS}^{Med} - PD_{Cross}^{Med}) \times (p + 50\%) \right) + N \times A \times \left( (PD_{EWS}^{Med} - PD_{Cross}^{Med}) \times (p + 50\%) \right).$$

With assumption that **two models has the same distribution on 3 levels of risk**, probability of default of each risk level in cross sale model is lower than that of EWS model, therefore, **the profit of cross-sale model is greater than the profit of EWS model**. The magnitude of  $\Delta_{Profit}$  for Retail unsecured product is presented on the next slide.



# Comparing financial impact

For example, if we take Retail unsecured segment and assume that:

- we have 1000 medium risk customers and 1000 low risk customers, who accepted top-up proposition,
- average disbursement for medium risk and low risk customers are USD 3,5K and USD 5K respectively,
- income of the segment is 3%,

rough calculation of financial impact of EWS usage and X-sale usage will be like the following

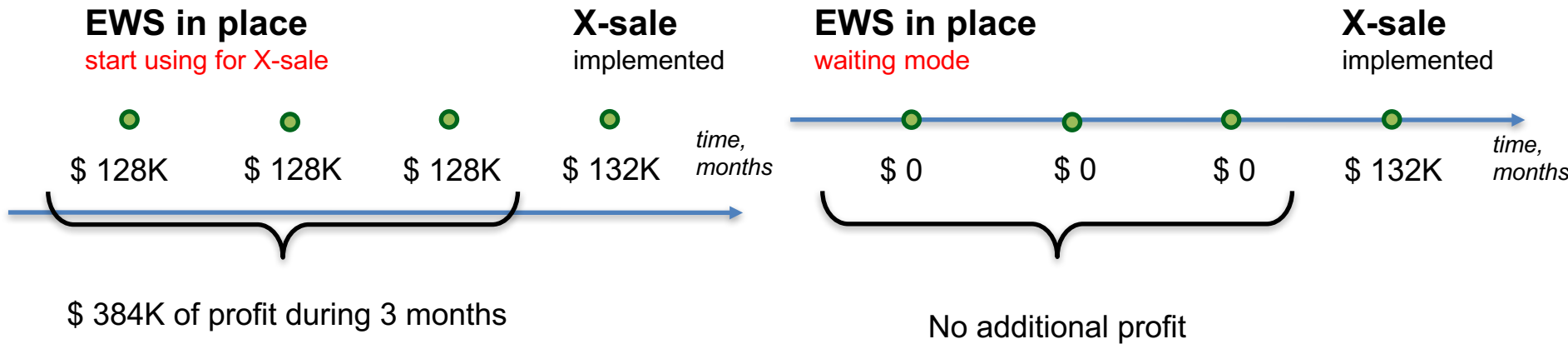


Risk level	Customer #	EWS Model				X-sale Model				$\Delta$ profit
		PD %	Income USD	Loss USD	Profit USD	PD %	Income USD	Loss USD	Profit USD	
High risk	1000	14.5				14.0				
Medium risk	1000	4.0	100 800	70 000	30 800	3.9	100 905	68 250	32 655	1 855
Low risk	1000	2.0	147 000	50 000	97 000	1.9	147 150	47 500	99 650	2 650
<b>Total</b>	<b>3000</b>				<b>127 800</b>				<b>132 305</b>	<b>4 505</b>

X-sale model for Retail unsecured segment gives USD 4,5K income more than EWS model, which is not a high number in comparison to profit earned. But taking into account time factor, the benefits will be even bigger.

# Conclusions

If we assume, that 3 months are needed for development and implementation of specially designed X-sale model, and we don't sell cross-sale products while waiting for the model to come up, we don't earn additional profit for the Bank:



## Conclusions:

1. If organization faces lack of time or resources, usage of EWS for x-sell and vice versa is more than justified.
2. EWS model works good for x-sell and x-sell model works well for EWS.
3. Specific models work better, but the difference is not significant.
4. If to choose which model to make first, given financial impact, it is advised to make x-sell model first and use it for EWS purposes.
5. Fast solution is more important than financial impact of the model.