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BINOMIAL MODEL FOR MEASURING EXPECTED CREDIT LOSSES FROM TRADE RECEIVABLES IN NON-FINANCIAL SECTOR ENTITIES

ABSTRACT

In July 2014, the International Accounting Standards Board (IASB) published International Financial Reporting Standard 9 *Financial Instruments* (IFRS 9). This standard introduces an expected credit loss (ECL) impairment model that applies to financial instruments, including trade and lease receivables. IFRS 9 applies to annual periods beginning on or after 1 January 2018 in the European Union member states.

While the main reason for amending the current model was to require major banks to recognize losses in advance of a credit event occurring, this new model also applies to all receivables, including trade receivables, lease receivables, related party loan receivables in non-financial sector entities.

The new impairment model is intended to result in earlier recognition of credit losses. The previous model described in International Accounting Standard 39 *Financial instruments* (IAS 39) was based on incurred losses. One of the major questions now is what models to use to predict expected credit losses in non-financial sector entities. The purpose of this paper is to research the application of the current impairment model, the extent to which the current impairment model can be modified to satisfy new impairment model requirements and the applicability of the binomial model for measuring expected credit losses from accounts receivable.

Keywords: Expected credit loss model, binomial model, IFRS 9, accounts receivable, financial instruments, incurred loss model

1. Introduction

In July 2014, the International Accounting Standards Board (IASB) published International Financial Reporting Standard 9 *Financial Instruments* (IFRS 9).¹ This standard introduces an expected credit loss (ECL) impairment model that applies to financial instruments, including trade and lease receivables. IFRS 9 applies to annual periods beginning on or after 1 January 2018 in the European Union member states.

While the main reason for amending the current model was to require major banks to recognize losses in advance of a credit event occurring, this new model also applies to all receivables, including trade receivables, lease receivables, and related party loan receivables in non-financial sector entities.

The new impairment model is intended to result in earlier recognition of credit losses. The previous model described in International Accounting Standard 39 Financial instruments (IAS 39, 2017)²

was based on incurred losses. One of the major questions for non-financial sector entities is what models to use to predict expected credit losses from trade receivables.

2. Characteristics of Trade Receivables

Entities typically sell products and services on credit rather than requiring immediate cash payment. Such credit sales generate accounts receivables or trade receivables. Trade receivables are financial assets which fall within the scope of International Accounting Standard 39 – Financial Instruments (IAS 39). From 1 January 2018 IAS 39 will be replaced by International Financial Reporting Standard 9 – Financial Instruments (IFRS 9). Trade receivables constitute a significant item on the Statement of Financial Position of entities in trading, manufacturing and non-financial services sectors. Trade receivables shown as percentage of total assets in Croatian entities are given in Table 1:

Table 1 Accounts receivable as % of total assets in 2013 and 2014 in Croatia – cumulative data for 104,470 entities

In mil HRK	2014		2013	
Total assets	1,072,907		1,044,848	
Long term accounts receivables	19,196	2%	18,995	2%
Short term accounts receivables	131,500	12%	129,685	12%

Source: FINA, 2015³

Trade receivables are usually classified as short-term financial assets held at amortized cost. However, trade receivables can be long-term assets. Examples of long-term receivables are lease receivables and contract receivables. Long-term receivables usually contain a significant financing component.

Most businesses have formal accounts receivable policies that dictate when to bill, how much to bill and when to collect. Unfortunately, not all businesses enforce those policies effectively – or even adopt the right processes at all. In many cases, it comes down to culture. Businesses that prioritize sales often fall into the trap of extending credit to customers, offering discounts or ignoring payment terms if it means winning new sales (Deloitte, 2017).⁴

To extend trade credit various processes take place (Milan, Smith, 1992):

- 1) assessment of credit risk of the potential account debtor;
- 2) making credit – granting decision (including setting credit terms);
- 3) financing receivable until maturity;
- 4) collection of receivable;
- 5) bearing default risk.

However, if management does not have a focus on trade receivables management, extending credit terms to customers will impact impairment of the trade receivables.

3. Impairment of Trade Receivables

Trade receivables would be considered impaired if their carrying amount exceeds their recoverable amount. The principle of impairment, set by stand-

ards, is the same for both standards IAS 39 and IFRS 9. However, the procedures in assessing the asset for impairment are quite different. IAS 39 is based on the “incurred loss model” while IFRS 9 is based on the “expected loss model”.

2.1 The Incurred Loss Model

IAS 39 requires all trade receivables to be assessed for impairment. However, the standard adopts different approaches to assessing and calculating impairment for different classification categories (financial assets) but the two most notable characteristics of the IAS 39 impairment model are that (Deloitte, 2017)⁵:

1. Impairment losses should be recognized when they are incurred, rather than as expected; and
2. An impairment loss should be regarded as incurred if, and only if, there is objective evidence of impairment as a result of one or more events that occurred after initial recognition (a ‘loss event’).

IAS 39 requires an assessment, at the end of each reporting period, as to whether there is any objective evidence that a financial asset or group of financial assets is impaired. An asset is considered impaired, and an impairment loss recognized only if such evidence exists.

IAS 39’s insistence on recognizing an impairment loss on receivables only when they are incurred infers the use of an “incurred loss” model in assessing the impairment on receivables. IAS 39 forbids recognizing losses expected as a result of future events, no matter how likely they are. The implication is that an entity must on a continuous basis reassess its ability to collect its receivables and to ascertain if there is objective evidence that a loss event has occurred. Loss events can be considered to be events that crystalize to form objective evidence of impairment; and examples may include significant finan-

cial difficulty of the parties involved; reports of accident on a customer’s major factory, or it becomes probable that the customer will enter bankruptcy (IAS 39, 2017).

According to IAS 39 receivables are tested for impairment individually for receivables that are individually significant and individually or collectively for receivables that are individually insignificant. If an entity determines that no objective evidence of impairment exists for an individually assessed receivable, whether significant or not, it includes the asset in a group of financial assets with similar credit risk characteristics and collectively assesses them for impairment. Assets that are individually assessed for impairment and for which an impairment loss is or continues to be recognized are not included in a collective assessment of impairment (IAS 39, 2017).

The application of IAS 39 provisions on impairment were observed on 10 biggest entities in Croatia according to revenue criteria in 2016. According to IFRS 7 – Financial instruments: Disclosure entities must disclose the following information (the list is not final) (IFRS 7, 2017)⁶:

- The amount of impairment loss.
- Trade receivables age analysis.
- Analysis of trade receivables that are individually determined to be impaired as at the reporting date.
- Factors the entity considered in determining individually impaired trade receivables.

Analysed data were taken from the financial statements publicly announced in the FINA registry for 2016. All observed entities were large entrepreneurs applying International Financial Reporting Standards. Also, financial statements of all entities observed were subject to financial statement audit in 2016 and 2015.

Table 2 Summary of research results on accounting for trade receivables in the biggest Croatian entities according to revenue criteria in 2016

	INA	HEP	Konzum	HT	Pliva	Petrol	Lidl	Plodine	Kaufland	ZGH
Trade receivables/ Sales revenues	10%	15%	2%	10%	14%	8%	1%	2%	1%	7%
Trade receivables/ Total assets	8%	5%	2%	5%	7%	21%	1%	3%	1%	1%
Disclosures according to IFRS 7										
The amount of impairment loss	Disclosed	Disclosed	Disclosed	Disclosed	Disclosed	Disclosed	No impairment	Not disclosed	No impairment	Disclosed
Trade receivables age analysis disclosed in notes	Disclosed	Disclosed	Disclosed	Disclosed	Disclosed	Not disclosed	Disclosed	Not disclosed	Not disclosed	Disclosed
Analysis of trade receivables that are individually determined to be impaired as at the reporting date	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed
Factors the entity considered in determining individually impaired trade receivables	Not disclosed	Not disclosed	Not disclosed	Disclosed	Disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Disclosed
Collective impairment criteria	Not disclosed	31-60 days 1,5% 61-90 days 3% 91-180 days 9% 181-365 days 30% over 1 year 90%	120 days	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	61 days	60 days

Source: Authors' research

Research summary - from the above table it can be seen that:

- 9/10 of the entities disclosed information on the amount of the impairment loss;
- 7/10 of the entities disclosed trade receivable aging report;
- 0/10 entities disclosed analysis of the trade receivables that are individually determined to be impaired;
- 3/10 entities disclosed factors they considered in determining individually impaired trade receivables;
- collective impairment criteria are not uniformly used;
- 2/10 entities used 60 days overdue criteria;
- 1/10 entities used 120 days overdue criteria;
- 1/10 entities used multiple overdue criteria;
- 6/10 entities did not disclose this information .

Based on the presented results it can be concluded that the amount of disclosed information on trade receivables impairment is not satisfactory. Qualitative information presented along quantitative information does not allow for the user of financial statements to assess the effectiveness of management of trade receivables. From the results presented it can be concluded that 60% of the entities assess trade receivables for impairment on an individual basis. Only 40% of the entities disclosed information that they use both individual and collective impairment of trade receivables. Factors the entity considers in determining individually impaired trade receivables are disclosed by only 30% of the entities, and those factors are general factors taken from IAS 39, with no detailed description on the applied policy. Several entities disclosed that impairment of trade receivables was done based on management experience.

From the lack of both quantitative and qualitative information in notes to financial statements, it can be concluded that the majority of observed entities do not have a formal policy for accessing trade receivables for impairment, which then leads to the problem of trade receivables information reliability. The results of this research are in accordance with results found in research papers by other authors (Dyhdalewicz, 2012).

Also, from the research it can be seen that the collective impairment criteria is not uniformly used. The majority of entities observed are using the binomial approach: either 61 days as the impairment threshold (2 entities) or 120 days (1 entity) and only one entity uses the provision matrix for impairment of trade receivables. The fact that the majority of entities that are using collective impairment (75%) use 60 days or 120 days overdue threshold of impaired trade receivables might be explained by the influence of the *Croatian Corporate Income Tax Act* which uses the same thresholds (120 days till 2015; 60 days from 2015). Similar results were found in research papers by other authors (Vićentijević, 2015).

3.2 The Expected Loss Model

Under an expected loss model, reporting entities are required to include adjustments to the carrying amounts of trade receivables as credit loss expectations change after inception. It also presumes that the initial carrying amount of receivables reflects the expected credit losses, whether estimated on an individual or portfolio basis. This initial recognition adjustment is consistent with the current IAS 39 requirement to recognize receivables initially at fair value however in practice no adjustment to the nominal amount of trade receivables is generally made.

3.2.1 Major Characteristics of the Expected Loss Model

The expected loss model should incorporate management's estimates based on past and expected future loss events on existing loans.

The development of an expected loss model should be consistent with the following principles (IFRS 9, 2017):

- a) An unbiased and probability-weighted amount that is determined by evaluating a range of possible outcomes;
- b) The time value of money; and
- c) Reasonable and supportable information that is available without undue cost or effort at the reporting date about past events, current conditions and forecasts of future economic conditions.

The Exposure Draft does not stipulate what an entity should consider when estimating the effect of credit losses on expected cash flows. It does how-

ever give high level guidance that provides that an entity may use various sources of data, which may be internal or external. For example, (IFRS 9 ED)⁷:

- a) Internal or external historical credit loss experience;
- b) Internal or external credit ratings;
- c) External reports and statistics; and
- d) Peer group experience for comparable financial assets (or groups of financial assets).

It is not clear in arriving at management's estimate of expected cash flows whether any particular source would have precedence over another. The reliability of data inputs may also need to be considered in this context. Management should also consider historical loss data and other information related to the financial asset, including the nature of the borrower, the product, the market, the economic outlook etc. However, market data, including implied credit spreads would be considered in management's estimates of future losses. That is, historical data such as credit loss experience should be adjusted on the basis of current observable data in order to reflect the effects of current conditions. Finally, an estimate of expected cash flows needs to take into account the concept of probability. The Exposure Draft requires that the estimates for cash flow inputs are expected values. Hence, estimates of the amounts and timing

of cash flows are the probability-weighted possible outcomes. That is, a probability weighted approach that results in frequent changes in estimates based on both the timing and amount of expected cash flows. A probability-weighted approach is more consistent with the way a market value is calculated and therefore is consistent with how a financial instrument is priced on initial recognition.

It is also noted that expected losses based on probability-weighted possible outcomes only include an estimate of the maximum loss that can be suffered based on what is expected to be lost on average in a time specific horizon and based on historical exposures. The unexpected loss is the portion that exceeds the expected loss. The expected loss will be measured as the standard deviation from the average expected loss within a certain level of probability/confidence (e.g. 95 or 99% of outcomes). The calculation does not incorporate losses outside that level of probability (e.g. such as worst credit loss in over 30 years). Hence the unexpected losses would be covered by equity or prudential provisioning rather than the expected loss model for impairment.

The full IFRS 9 impairment model is based on changes in expected credit losses and involves a three-stage approach. The recognition of impairment (and interest revenue) is summarised in Table 3.

Table 3 Summary of the recognition of impairment (and interest revenue) under IFRS 9

Stage	1 Performing	2 Underperforming	3 Non-Performing
Recognition of impairment	12-month ECL	Lifetime ECL	
Recognition of interest revenue	Effective interest on the gross amount		Effective interest on the net amount

Source: Basford, Leung (2015)⁸

The model includes some operational simplifications for trade receivables, contract assets and lease receivables, because they are often held by entities that do not have sophisticated credit risk management systems. Under the 'simplified' approach, entities with short term trade receivables will recognise 'lifetime expected credit losses' from the first reporting period. These are the credit losses expected over the term of the receivable. As a practical expedient, a provision matrix may be used to estimate ECL for these financial instruments (IFRS 9, 2017).

For trade receivables or contract assets which contain a significant financing component in accordance with IFRS 15 and lease receivables, an entity has an accounting policy choice: either it can apply the simplified approach (that is, to measure the loss allowance at an amount equal to lifetime ECL at initial recognition and throughout its life), or it can apply the general "3 stage" model (IFRS 9, 2017).

Applying the 'simplified' model alleviates some of the operational challenges associated with the 'full' model e.g. assessing whether there has been a sig-

nificant increase in credit risk. However, applying the 'simplified' model will most likely lead to a higher provision than the 'full' model because:

- Under the 'simplified' model, all expected credit losses would be provided for at the first reporting date.
- Under the 'full' model, only a portion (12 months) of credit losses are provided for, (life time expected credit losses are not recognised until there has been a significant increase in credit risk of the receivable under the 'full' model).

Some non-financial services entities do not manage their receivables on a portfolio basis and as a result, it may be difficult to accurately estimate future cash flows on an expected (probability-weighted) basis. Given the reasons stated in the above paragraphs and the short-term nature of receivables, this will be a difficult implementation issue for non-financial services entities (EFRAG & FEA, 2009)⁹.

3.2.2 Comparison of the Expected Loss Model with the Incurred Loss Model

The incurred loss model and the expected loss model report credit losses from different perspectives. The incurred loss model is based on the perspective of allocating a credit loss to the period when that loss is incurred. The expected loss model allocates the initially expected credit loss to the periods when revenue is recognized from the financial asset.

The key difference between the expected loss model and the incurred loss model is when credit losses are recognised. Under the incurred loss model, credit losses are recognised only when those losses have been - incurred, that is, there is evidence that the losses are probable and measurable. Under the expected loss model future expected credit losses form part of an initial determination of the effective interest rate, resulting in expected credit losses being recognised as a reduction of the interest accrual. Additional - impairment adjustments to the carrying amount of the asset are made as future expectations about future credit losses change. This is a continuous re-estimation and does not rely on the - incurred trigger of the incurred loss model. However, immediately after the loss event, the requirements to estimate loss outcomes under the two models are identical and existing systems could

therefore be used to capture impairments from that point (EFRAG & FEA, 2009).

In terms of users of financial statements, the information provided by the expected loss model is generally seen to provide more relevant information since it treats credit loss (impairment) on a consistent basis as revenue recognition. In addition, the results of the model will more closely reflect current economic conditions at the reporting date i.e. it will reflect management expectations at that point in time (EFRAG & FEA, 2009).

However, increased relevance needs to be considered in the context of operational complexity. In assessing whether to adopt the expected loss model for impairment, consideration of whether the operational costs of implementation by preparers is outweighed by the benefits to users would be necessary. Furthermore, the expected loss model results in an increase in the use of management judgement required to calculate the amortized cost of financial assets. Concerns have been raised that an increase in the reliance on management judgement to estimate future cash flow may reduce the reliability of amortized cost information in the financial statements and may make auditing of such information more difficult.

4. Comparison of the Binomial Model and Provision Matrix for Measuring Expected Credit Losses from Trade Receivables

4.1 Provision Matrix

An entity may use practical expedients when measuring expected credit losses if they are consistent with the principles for developing the ECL model. An example of a practical expedient is the calculation of the expected credit losses on trade receivables using a provision matrix. The entity would use its historical credit loss experience for trade receivables to estimate the lifetime expected credit losses on the financial assets as relevant. However, an entity shall adjust historical data, such as credit loss experience, on the basis of current observable data to reflect the effects of the current conditions and its forecasts of future conditions that did not affect the period on which the historical data is based, and to remove the effects of the conditions in the historical period that are not relevant to the future contractual cash flows.

A provision matrix might, for example, specify fixed provision rates depending on the number of days that a trade receivable is past due (for example, 1 per cent if not past due, 2 per cent if less than 30 days past due, 3 per cent if more than 30 days but less than 90 days past due, 20 per cent if 90 - 180 days past due etc.). Depending on the diversity of its customer base, the entity would use appropriate groupings if its historical credit loss experience shows significantly different loss patterns for different customer segments. Examples of criteria that might be used to group assets include geographical region, product type, customer rating, collateral or trade credit insurance and type of customer (such as wholesale or retail).

Table 4 Provision matrix based on aging of the trade receivables

Aging of the trade receivables	Expected default rate
Not past due	1%
1-30 days past due	5%
31-60 days past due	25%
61-90 days past due	50%
More than 91 days past due	75%

Source: Authors' proposal according to IFRS 9, 2017

Given the results of the research on the application of the impairment provisions of IAS 39, the majority of the entities are not able to apply this (practical expedient) approach to trade receivables impairment without considerable effort and time spent to identify aging groups of trade receivables and related expected default rates, since currently they are using the binary approach to trade receivables impairment (60 or 120 days). As research has shown, the majority of entities commonly use individual impairment based on management historical experience and expectations. Collective impairment is usually based on one overdue threshold (60 or 120 days). That indicates, that entities would have to adjust their current impairment models significantly to apply this practical expedient.

3.2 The Binomial Model

The binomial model assumes that the debtor (trade receivable) will either default or will remain in its current credit quality. This approach assumes no transition in credit quality. The binomial model assumes that movements in the credit quality follow a binomial distribution, for many trials, this binomial distribution approaches the lognormal distribution.

The probability of default under this model is developed based on 1-year probability of default rate.

The cumulative distribution function can be expressed as:

$$F(k; n, p) = \Pr(X \leq k) = \sum_{i=0}^{\lfloor k \rfloor} \binom{n}{i} p^i (1-p)^{n-i}$$

where:

$\lfloor k \rfloor$, is the "floor" under k, i.e. the greatest integer less than or equal to k.

n, number of years

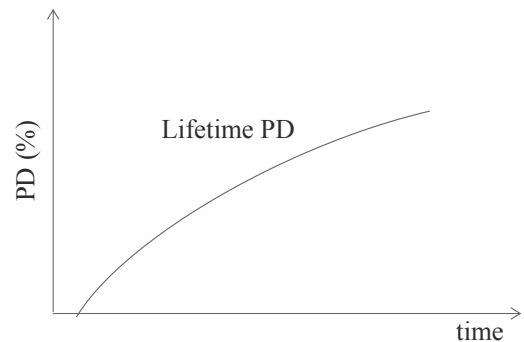
p, probability of default

Therefore,

Lifetime probability of default for financial instrument with 3-year maturity

$$= PD_1 + (1 - PD_1) \times PD_1 + (1 - PD_1)^2 \times PD_1$$

Figure 1 Lifetime PD



Source: Authors

Because trade receivables are mostly short-term assets, it is necessary to adjust the general model to reflect the short-term nature of these assets. That

means it is important to redefine parameter n as the number of months, while the other variables of the binomial function remain the same as in the general model. Probability of default (PD) for one year can be approximated by calculating the average portion of uncollected receivables in the last few years in total credit sales (e.g. last 5 years). Furthermore, the annual average PD is then divided by 12 months to approximate monthly PD. Then, this approximated monthly PD based on historical data is adjusted for current conditions and forecasts of future economic conditions.

The advantage of this model is simplicity, and availability of data needed to determine probability of default. The calculated probability of default can be used for the total portfolio of receivables which make it simple to implement. Also, this model is statistically verifiable which is an important factor to assure neutrality of financial information as a qualitative characteristic of financial statements.

5. Conclusion

The aim of this paper was to research the applicability of the binomial model for measuring expected

credit losses from trade receivables in non-financial sector entities. For that purpose, an analysis of the current situation was performed in ten biggest entities in Croatia based on revenue criteria in 2016. The research results showed that the majority of the entities observed use only the individual impairment approach. The ones that use collective impairment of trade receivables dominantly use the binomial approach. Only one entity uses the provision matrix for collective impairment of trade receivables. The IFRS 9 offers simplification for trade receivables regarding measurement and recognition of lifetime expected credit losses and use of the practical expedient "provision matrix" for measuring impairment loss from trade receivables. Given the results of the research, it can be concluded that entities would benefit from the use of the binomial model for measuring impairment losses since they would have to make fewer adjustments of their current impairment model to the binomial model than to the provision matrix model. Future research should be focused on the entities' adoption of the new model introduced by IFRS 9. Also, investigation should include potential improvement in the quality of information presented in financial statements.

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BINOMNI MODEL ZA MJERENJE OČEKIVANIH KREDITNIH GUBITAKA POTRAŽIVANJA OD KUPACA U SUBJEKTIMA NEFINANCIJSKOGA SEKTORA

SAŽETAK

U srpnju 2014. godine Odbor za Međunarodne računovodstvene standarde (IASB) objavio je Međunarodni standard financijskoga izvještavanja 9 - Financijski instrumenti (MSFI 9). Ovaj standard se temelji na pristupu očekivanih kreditnih gubitaka (ECL) kod utvrđivanja umanjenja vrijednosti financijskih instrumenta, uključujući potraživanja od kupaca i najmove. MSFI 9 primjenjuje se na izvještajna razdoblja koja započinju na dan ili nakon 1. siječnja 2018. u državama članicama Europske unije.

Iako je glavni razlog promjene modela utvrđivanja umanjenja vrijednosti financijskih instrumenta bio da banke priznaju gubitke od umanjenja prije nego li se dogodi događaj koji umanjuje vrijednost instrumenta, novi se model jednako odnosi i na sva potraživanja, uključujući potraživanja od kupaca, potraživanja za najmove, potraživanja po zajmovima povezanim subjektima u subjektima nefinancijskoga sektora.

Novi model utvrđivanja umanjenja vrijednosti rezultat će ranijim priznavanjem kreditnih gubitaka. Prethodni model opisan u Međunarodnom računovodstvenom standardu 39 Financijski instrumenti (MRS 39), temelji se na nastalim gubitcima. Jedno od glavnih pitanja je kako predvidjeti očekivane kreditne gubitke u subjektima nefinancijskog sektora. Svrha ovog rada je istražiti primjenu postojećega modela umanjenja potraživanja od kupaca, procijeniti mogućnost modifikacije postojećeg modela kako bi se zadovoljili zahtjevi novog modela te primjenjivost binomnog modela za mjerenje očekivanih kreditnih gubitaka potraživanja od kupaca.

Ključne riječi: model očekivanih kreditnih gubitaka, binomni model, MSFI 9, potraživanja od kupaca, financijski instrumenti, model nastalih gubitaka