First step towards ESG Impact Score

Discussion Paper

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Authors: Thomas Maul (PPI AG), Dr. Radoslava Mirkov (mathcube Berlin)

Storyline

As we discussed in Maul/Mirkov 09/2020 paper, selecting and analyzing data for ESG scoring of customers can be very challenging for banks.

At the same time we see some available ESG scores from several well-known agencies in the market. These ESG scores or ESG labels refer to the suitability of businesses to the UN and European goals concerning sustainability, mostly with the focus on the companies' contribution in reaching or failing these goals, and also with respect to the best practices for social responsibility and corporate governance. This approach leads to an interpretation of the relevant scores and subscores as mainly reputational ESG scores. Their main purpose is to support investors in selecting assets with respect to their own sustainability preferences. In addition, this selection puts pressure on the need of transformation of the (global) economy.

For banks these labels are also important for the reason that their own behaviour will be scored, too. And if they lend money to borrowers with “brown” ESG scores their own score will hardly be “green”. It is clear that this could cause reputational risks in the business models of the banks in the long term, since investors and customers would likely prefer other banks with a better ESG reputation.

These reputational ESG scores are related to timelines which are usually focussed on the years 2035 or 2050+, when global and European environmental and climate goals should be met. But this transition period, before the economies are transformed into sustainable mode is quite long compared to the typical maturity of commercial loans.

In addition it is important to know that banks need to score their loan portfolios regularly with respect to credit risk. This typically annual review of the solvency of loan customers has to be widened in the way that the focus does not longer lie only on the creditworthiness of the borrower, but also banks need to consider expected or possible impacts linked to ESG risks.

If we consider the effects of ESG risks on credit, market and liquidity risk, besides reputational effects we discussed, and which are covered by ESG reputational score, the analysis of newly collected time series should lead to the identification of variables and mechanisms which are explaining reliably and consistently the impact of ESG risk to the bank’s estimation of borrowers’ creditworthiness. We still believe in this approach, but we also think it will take a considerable amount of time to collect such data. Additionally, it will take time until a consistent metric suitable for measuring ESG impact on PD scoring without making too many expert approximations is established in the market.

Therefore, for the time being we suggest a new, simpler approach, based on readily available data and some expert based assumption, and introduce what we call the transition curve mechanism, which will be relying on existing reputational ESG scores. The transition curve is used to transform reputational ESG scores into borrower's individual ESG risk impact scores for estimating its impact on credit, market and liquidity risk. This curve enables banks to take into account the specific properties of loans and the respective customers, and allows individual scoring of loan takers. Moreover, the transition curve can also be used to estimate transitional effects of physical risks.

The transition curve

In this paper, for simplicity reasons, we focus only on transitions induced by politics and society. The same approach can also be applied to other transitional changes that influence creditworthiness of loan customers and even for evolving hazardous physical events.

To motivate the idea of the transition curve, let us start with an example: after the Paris Agreement the EU introduced the European Green Deal which aims to be climate-neutral by 2050, what means an economy with net-zero greenhouse gas emissions. The path to matching that goal is our transition path. It is clear that politics and laws will change and that investors and customers will put pressure on the firms to transform their business models and technology. This means we have to expect several steps and waves that force the firms to adapt. But we don't know the exact path and probably some of the steps lie still in the future. For instance, coal operated power utilities will be shut down in Germany by 2038. So a loan to a company from that industry with a maturity before 2028 will not be as affected as a loan with maturity 2040. So the impact of that ESG transition is dependent on the time to maturity of the respective loan. Although the reputational ESG score might be very brownish for such a company, the ESG impact score which expresses possible impacts of ESG transition to the loantakers' creditworthiness could indicate lower risks. But we do not know if there could be some events that lead to a further acceleration of transition, as we have seen for instance in the German shut down of nuclear power plants.

Before we introduce the transition curve it is important to know that we are not trying to estimate event risks since this needs different measures. And we suppose that the current credit scores (or PDs, probabilities of default), if dependent on the time to maturity, also reflect the currently known transitional changes, as for instance the above mentioned shut down. Thus, we concentrate on future changes and want to estimate their influence on the current ESG impact score.

A first approach towards describing the transition process over time would be to assume a linear development. But such a process seems in our opinion far away from the empirical experiences. Next we could choose a step by step discrete time process which allows us to change the number of steps as well as the height and the width of each step. This approach will lead to the effect that impact scores might also jump from one date to the other. But usually, the changes happen smoothly over time, sometimes fast and sometimes slowly.

This implies some properties the transition curve should have:

- It should be continuous in time, to avoid jumps at specific time points,
- It should allow for taking into account the timeframe and the dynamics of the changes, in the sense that some changes happen very fast and some changes will take longer time to be completed,
- The dynamics of the changes is not always constant in speed, and for e.g. can be faster at the beginning of 30 years time period and slower later, or vice versa,
- It should be able to diminish or adjust the effect of reputational ESG score to the ESG impact score depending on the duration of the loan,
- It should support the idea of minimum and maximum level of impact.

For this reason, we suggest the utilization of sigmoid (log-logistic) curves with 5 parameters to model the transition properties which yield the current ESG impact score of a loan.

Mathematically, a sigmoid curve is given by

$$y = d + \frac{a - d}{\left(1 + \left(\frac{t}{c}\right)^{b}\right)^{e}}$$

and has 5 parameters:

a = the minimum value that can be obtained, i.e. what happens now or what is the expected minimum impact,

d = the maximum value that can be obtained, i.e. what happens in years 2050+,

c = the point of inflection, i.e. the point in time on the S shaped curve somewhere halfway between *a* and *d*, when some relevant change in society and politics happen,

b = Hill's slope of the curve, which is mathematically related to the steepness of the curve at point *c*, and describes the speed of the transition,

e = asymmetry factor, describing the dynamics of the change, for *e*=1 we have a symmetrical curve around inflection point, for *e*<1 the changes happen faster at the beginning of the observed time period, and for *e*>1 at the end of the time period.

In our case, *t* is the time to maturity of a loan in years, and the dependent variable y is ESG impact score (ESG-IS), see also [1].

Of course, any other continuous curve satisfying properties described above can be used instead of the sigmoid function. Also, depending on the transition scenarios we want to describe, maybe some other model would better describe it, e.g. with allowing for more than one transition point in time with different dynamics. But for this presentation, we have chosen a sigmoid model as an appropriate possible way of describing the transition scenarios, see Fig 1.

As an economic interpretation this function represents the legislative process and the pressure on the companies to adapt within given the time to meet the goals, whereby the usual time to maturity of loans is shorter. If one compares the time to maturity with the shape of the transition curves the effect of influence of the transition itself on the business model of the customer and thus on its creditworthiness during the lifetime of the loan can be estimated (Fig 1). As a result the transition curve transforms the time to maturity into a factor

between zero and one which can be used to calculate the degree of influence of the legislative transition process. This leads to a consistent estimation of the ESG related part of credit risk.

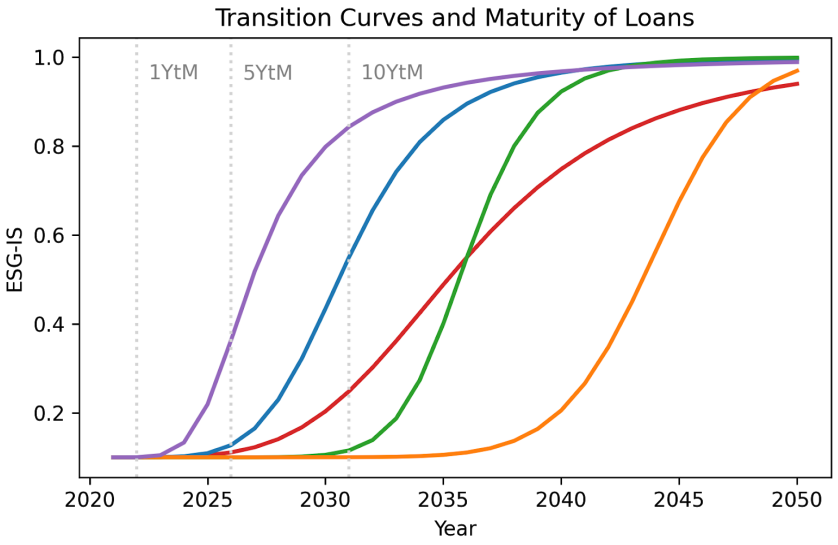

Fig 1: Transition curves that represent possible paths or scenarios of transition and examples for maturities of loans

Each parameter can be brought into relation to a specific scenario which represents one possible legislative process, all the way till 2050 in the case of decarbonisation. Obviously, these parameters cannot be derived from historical observations since this transition is unique in history. But based on the experience with other legislative processes, we can estimate the parameter values of the function and thus obtain ESG-IS.

So the parameters and therefore the shape of the curve should meet the expert expectations of the transition process within the considered scenario with respect to the dynamics and strength of the impact.

Scratch of risk calculation

ESG scores representing reputational risk and compliance risk with respect to meeting the sustainability goals and time to maturity of the observed loans are the basis for calculating ESG impact scores as the transition curves provide the main contribution to adjust the scores in the desired manner.

If we take into account the time to maturity of several loans we get for each maturity the value of the transition curves for a specified scenario (Fig 2). This value represents the degree of impact on how the business model and therefore the creditworthiness of the loan taker is affected by the relevant scenario. One now can decide if to take the highest or lowest value of the impact scenarios or a weighted average as the ESG-IS.

The gained ESG-IS can now be used to weigh the reputational ESG score by multiplying what leads us to the wanted specific ESG impact score of the respective loan of the respective customer.

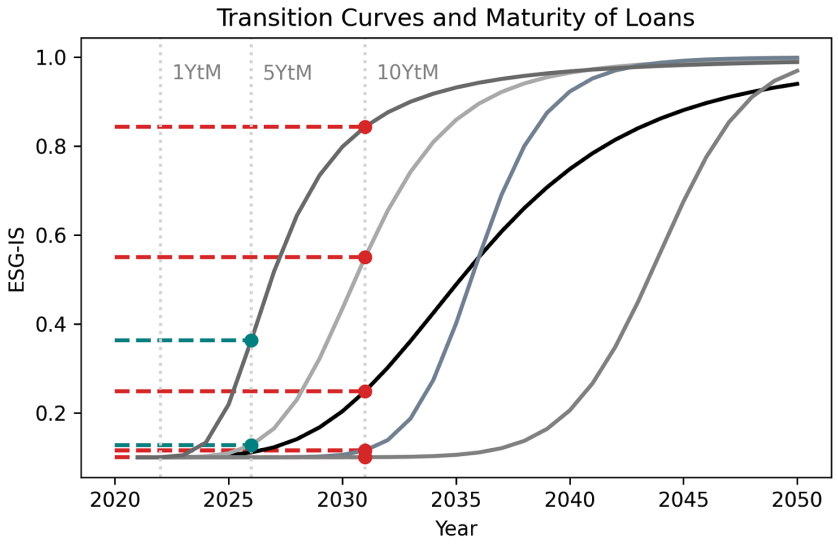

Fig 2: Red signs mark the level of the impact under the relevant transition scenario.

Keep in mind, this ESG impact score does not show you the materiality of the possible risk impact under the relevant scenario(s) but gives the idea how likely the specific loan is impacted by transition during its lifetime. For instance if the ESG-IS of a loan is “green” you know that this contract will likely not severely change your risk profile when the relevant transition scenarios become reality.

The way towards quantifying the risks under the relevant scenario is quite straight. For this you will have to select and estimate the parameters at the point of the transition curve which leads to the ESG-IS and estimate the parameters (such as PD, LGD) and all the other KRIs you need for calculating the credit, market, liquidity and other risks.

Conclusion and further discussions

We have seen how the ESG impact score for a specific loan can quite easily be derived from the reputational ESG score of a customer. It is obviously a simple approach which can be implemented easily and thus enables banks to calculate the economic risks that are induced by the ESG transition. But keep in mind that we supposed that during the transition process business models wouldn’t change. That is a hard assumption since the scenarios look over a quite long period of time. But this assumption is widely spread in the banking industry as it is also used when estimating PDs or calculating risk on a farther time horizon (“no action assumption”). Therefore the results of risk calculation should be wisely interpreted.

We also propose to evaluate a further use of the transition curve approach. If physical events start gaining higher frequency and higher impacts during the transition process, the transition curves could also be used to estimate the effect of physical ESG risks. The same

applies if one can imagine scenarios for the changes in acceptance concerning social and governance indicators in the ESG universe.

One important topic that also has to be discussed further is the procedure on how one can obtain a reputational ESG score for every customer. The problem to be solved is that publicly available reputational ESG scores should be consistent with the bank's internal reputational ESG master scoring table. One has to deal with the fact that available public ESG scores cannot easily be transformed into each other since the methodologies of the agencies differ drastically.

So, stay tuned, we will be discussing some of these questions soon!

References

[1] Giuseppe Cardillo (2021). Five parameters logistic regression - There and back again (https://github.com/dnafinder/logistic5), GitHub. Retrieved January 14, 2021.