July 2013

Critique and Commentary in Response to Article written by Carlehed and Petrov in JRMV

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In a recent article in this Journal, Carlehed and Petrov (henceforth 'C&P') presented a method for determining point-in-time (PIT) and through-the-cycle (TTC) probabilities of default (PD). In their article, C&P describe an existing approach for deriving PIT and TTC PDs described by Aguais *et al* (2008); however C&P's summary of the article by Aguais *et al* contains errors. We present here clarifications that address those errors and provide additional opinions on some assertions made in C&P's article. After that, we list some lessons that we have learned in implementing PIT and TTC PD frameworks at two institutions and summarize our views on the proper application of PIT and TTC PDs.

Rebuttal to the claim that our method applies only in the cases of grades that are fully PIT: On page 6 of their article, C&P's state "Here we would like to mention the work of Aguais *et al* (2008), who propose a method similar to ours. However, their method is only for 100% PIT models (not hybrids), hence, they do not define the degree of PIT-ness." This assertion is false. On the contrary, we assume that, before introducing the credit-cycle indexes integral to our approach, the grades or modeled PDs may fall anywhere within the 0% to 100%, PIT range. Page 289 of Aguais *et al* we remark, "d(f) indicating the degree from 0 to 100% that an obligor's or account's DD measure is PIT". Further, under our approach to PD modeling, we estimate the extent to which the inputs other than the credit-cycle indexes give rise to PDs that rise and fall with the cycle. It is true that we seek to produce PDs that are fully PIT and fully TTC. These PDs and not the hybrids are the ones needed in risk and portfolio management applications.

Rebuttal to the claim that our method is limited to external ratings: On page 6, C&P say "In addition, they use an external ratings based approach for Z-estimation, which can easily be incorporated into our method." C&P suggest that our approach is restricted to using an external, 'rating system' as the credit-cycle indicator. Our PIT-TTC approach and we suspect any credible approach relies on having at least one and preferably more than one index measuring variations over time in credit conditions, broadly defined. Such an index or indices could derive either from information internal to an institution or from external information, perhaps pooling across institutions. However, the information must be representative of each sector identified as systematically important.

As demonstrated in Aguais *et al* (2008), we use a comprehensive set of PIT PDs, specifically MKMV's Public-Firm-Model EDFs (or possibly Kamakura Default Probabilities (KDPs)). In practice, we've found that, to obtain samples large enough to support the development of credible, credit-cycle indexes, one usually must draw on such external information. This isn't a logical restriction, but rather an assessment of the quality and volume of information required for accurate estimation of PIT and TTC PDs. Portfolios of particular institutions sometimes shift as business strategies change or risk appetites move and so indexes summarizing such portfolios may exhibit variations over time unrelated to the cycle. By drawing on external data describing very large portfolios, we believe that one has the best chance of obtaining indexes that reflect strictly cyclical variations. More specifically, such data sources offer consistency over time. For example, the current, MKMV Public Firm model is version 8, but MKMV provides EDFs arising from this same version back to 1990. In our experience this consistency and coverage is unmatched compared with other sources in which either rating methods have changed without retrospective restatements (e.g. Agency grades and the related, default rates by grade) or default collection processes that have varied over decades (e.g. bank internal default samples).

Comments on the not so clear benefits of using actual default statistics: On a related matter, on page 6 and 7, C&P mention "we see an advantage in using actual bankruptcy or default statistics as, in our opinion, these have a closer connection to default modelling of the particular obligor, they exhibit the correct level of volatility and they allow us to apply the method on a quarterly basis." We agree that defaults are the events that PD models must explain and, given very large volumes of default data, such information would provide the best measures of broad-based, credit conditions. However, in wholesale credit, the default samples are often small. Thus, on account of sampling variation, the raw default data can provide inferior measures of broad, cyclical fluctuations. For this reason, as demonstrated in Aguais *et al* (2008), we've made use of the MKMV EDFs, which arise from a model calibrated to a large sample of defaults spanning many sectors. We view the model-derived indexes for particular sectors as 'instruments,' or unbiased estimates subject to errors smaller than those intrinsic to the estimates that would derive from raw default data. Indeed, this use of instruments is particularly valuable in some sectors (e.g. Asian banks) in which no defaults may occur for substantial periods of time.

Comments on the use of experts in quantifying credit cycles: After questioning our usual approach of drawing on external indicators in deriving credit indices, C&P acknowledge on page 18 of their article for the need for information other than default data, "Typically, this problem is combined with a short historical time series of default/bankruptcy statistics." As an alternative to default data, C&P suggest that one might derive indexes from analysts' opinions. We doubt that one can rely on such sources. To have confidence in such opinion-based indexes, one would need to validate them by comparing with objective data and, in that case, the objective data would render the analyst-based indexes unnecessary. In our experience, analysts' opinions are vulnerable to the psychological tendencies of anchoring (excessive reliance on one's own, limited experience) and hindsight bias (the future is always above the historical-average risk now rationalized by a narrative).

The use and interpretation of alpha: C&P introduce the variable α and call it the degree of PIT. C&P state "We may arrive at the same definition by a slightly different reasoning: in a hybrid model, a certain part of the economy effect is already averaged and incorporated in the rating model PD. We model this by reducing the economy effect by a factor α" This discussion, however, is incomplete. It considers one feature of the adjustment – PITness of a hybrid model – and misses another -- correction of basis risk in the best available, but less-than-ideal reference index.

In our models, we try to adjust for both of these features. We present below two examples, which show that our approach is more comprehensive:

- Consider a portfolio of hedge funds that predominately short the market, i.e. their value falls and credit risk increases when the equity market does well. Because of the absence of a sufficiently specialized, credit-cycle index, we make use of a proxy index derived from say EDFs of banks. However, we assign a negative multiplier and a positive PIT-ness in this case because the riskiness of hedge funds would increase when banking EDFs fall and decrease when banking EDFs increase. In C&P's approach, the credit cycle could be created from say banks defaults but because alpha is floored to zero, CP's approach would not be able to capture this special case.

- Consider a case where we place Swedish corporate entities into two groups: one with higher volatility (HV) of defaults and one with lower volatility (LV). If we consider the LV group as the internal portfolio and make use of credit indexes from the HV group, the calibration calculations would naturally give us an alpha less than one which is understandable. However, if we consider the HV group as the internal portfolio and make use of a credit index from the LV group, we require an alpha greater than one which is not allowed under the C&P approach.

These cases highlight the importance of splitting the two components of degree of PIT-ness and credit cycle modification which is best assessed and calibrated separately.

Comments on CP's use of the terms 'conditional' and 'unconditional': We define the PIT PD as the unconditional expectation of an entity's DR and the TTC as a particular, conditional expectation. C&P's article takes a contrary view, using different language. They describe the PIT as conditional, meaning that it takes the known, current state (including the relevant history) as given, and the TTC as unconditional, meaning that it arises as an average over all, conceivable, current states, including those that didn't occur but might have been. But this use of the terms 'conditional' and 'unconditional' is unorthodox and backward looking. 'Conditional' as usually understood refers to circumstances in which one assumes something restrictive about the *future*. The current state is known, so one doesn't need to form an average with respect to it. Indeed, if one did, only the known, current state would enter into the average. 'Unconditional' refers to averaging with respect to all possible, *future* states. We follow the usual conventions in defining PIT and TTC. The PIT PD is, in principle, an average over all, possible, future states of the world. The TTC involves conditions that restrict the range of states, specifically to those that start from the long-run norm and arise, going forward, from a Geometric Brownian Motion (GBM) process.

Some lessons learned in our experience in implementing PIT and TTC, default and loss measures: We view our approach as described in Aguais *et al* (2008) and implemented in two large banks as a comprehensive framework for deriving PIT and TTC PDs. We appreciate C&P's initiative in contributing to this field. We intend to write a more detailed article in the future but for now, to help other developers, we list some lessons in implementing a PIT-TTC framework. In particular, we have found that successful implementation of PIT and TTC models hinges on:

- Convincing credit officers to think not just about grades, but about estimating PDs and then deriving grades from those PDs.
- Keeping models simple, in the case of PD models reflecting the Merton approach in which default risk arises from the interplay of leverage and volatility, and avoiding purely data-driven techniques.
- Validating PD, LGD, and EAD models jointly, by reconciling with losses consolidated over enough time periods and asset classes for reliable testing, and, after that, given sufficiently large samples, reconciling individual models with the related, default, exposure, or loss experience.
- Correcting for accreting conservatism in judgmental assessments and avoiding selection bias in calibration samples.
- Adjusting for lags in, for example, financial data that can produce out-of-phase assessments.
- Identifying regulatory and user constraints, and thereby allowing regulators and users to appreciate the impacts of their behavior.

Comments on applying PIT and TTC PDs appropriately: The PIT PDs describe default risk at the current time, starting now and extending over a specified horizon. These PDs are the ones that a creditor needs to use in pricing for risk, managing risk in credit portfolios, and running baseline and stress scenarios. The TTC PDs describe default risk under hypothetical, long-run average conditions. Under some views of the evolution of systematic, credit conditions, specifically that they follow mean-reversion-momentum processes, the TTC PDs, applied across large portfolios, describe default risk on average over many, future years. So in long-horizon applications, including capital and portfolio planning, these PDs have a role, perhaps the principal one. In addition, the regulators, concerned about excessive credit in good times and downward spirals in bad, call for the use of TTC PDs in calculating RWA. So this is a clear application. Beyond that, some bankers may favour TTC over PIT PDs, because the former are less volatile. The greater stability of TTC PDs makes them less disruptive to credit approvals, contract negotiations, limit management, and near-term planning. Further, in their stability, the TTC PDs may resemble legacy or agency grades that are familiar and, on that account, often accepted. While these matters of convenience and familiarity can have

considerable influence within institutions, one has difficulty justifying stability at the expense of accuracy.

References:

(1) Carlehed M and Petrov A, A methodology for point-in-time–through-the-cycle probability of default decomposition in risk classification systems, Journal of Risk Model Validation Volume 6/Number 3, Fall 2012 (3–25)

(2) Aguais, S., Forest Jr., L. R., King, M., L., Lennon, M. C., and Lordkipanidze, B. (2008). Designing and implementing a Basel II compliant PIT–TTC ratings framework. In The Basel Handbook, 2nd edn, pp. 267–297. Risk Books, London, available at http://mpra.ub.uni-muenchen.de/6902/1/aguais_et_al_basel_handbook2_jan07.pdf

(3) Aguais, S. D., L. R. Forest, E. Wong and D. Diaz-Ledezma, 2004, "Point-in-Time versus Through-the-Cycle Ratings", in M. Ong (ed), The Basel Handbook: A Guide for Financial Practitioners (London: Risk Books)