

ensemble^x

Measuring Payment Shock

White Paper

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April 2020

Introduction

We've spent a lot of time talking to clients and other lending industry leaders over the past few weeks. It's clear now that the standard tools that we've used as lenders over the last several decades aren't suited to this fast-changing environment. An extraordinary crisis requires some new, non-traditional tools.

We've developed a new report that quickly and succinctly captures the impact of delinquency, forbearance and other loan modifications in payment behaviors. This new report provides a clear diagnostic to guide the urgent strategic adjustments necessary to navigate the current crisis.

Our Favorite Chart

Whenever we look at an installment lender, the first chart we always want to see is the "Payback Chart." This chart plots the cash-on-cash returns for every vintage. Simply put, it shows for every dollar you loan, how much you get back and over what timeframe. Typically, we want to see how that curve looks for every month, quarter or year depending on the business.

Figure 1¹ shows a simplified version of the chart. The horizontal axis is time and the vertical axis is the cumulative ratio of payments to loan amount. Different businesses will have different expectations of the ratio they expect to get paid and the duration, but within a business this helps to identify which vintages are performing in line with expectations.

As a tool to monitor vintage performance over time, the Payback Chart has always been our favorite.

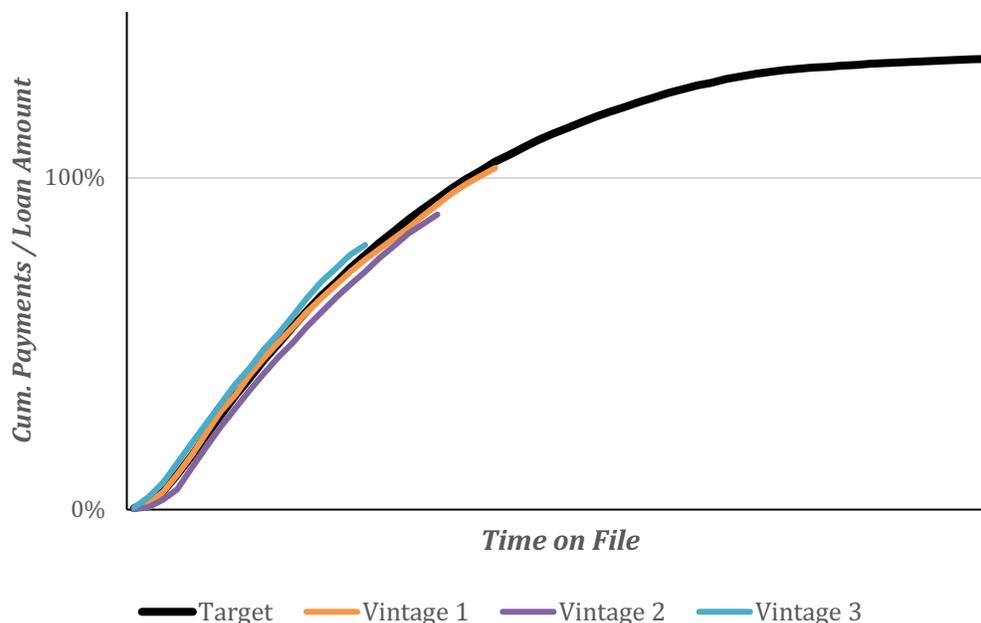
How The Payback Chart Let Us Down

Naturally, we've turned to the Payback Chart in this time of stress to see how our clients' portfolios are holding up. We know that it's a bit early to see results flowing through payments given the sudden onset of the economic crisis. However, we want to help our clients have data-driven insights as soon as

¹ This chart is based on data that is representative of our clients and it is directionally accurate, but it is not actual client data.

possible, so we ran some analysis using the Payback Chart. The results were that we didn't see any discernible performance deterioration in the vintage curves.

Figure 1 – The Payback Chart



It turns out that the Payback Chart is not good at detecting sudden payment deterioration, like those from COVID-19, for the following reasons:

- The vintage curves are cumulative curves showing total payments over time, meaning they can mask marginal changes between payment periods. A sharp change in payments from one week to the next can be lost in the overall scale of total payments received.
- The chart is aligned by time on file so impacts that are calendar-based are scattered across the horizontal axis making them harder to identify.
- The magnitude of a similar relative impact is different at different maturities. A significant drop in payments late in the curve (where it is flatter) has less visible impact than a comparable drop early in the curve (where it is steeper).

In a sense, we already knew about these issues. For instance, we know that the Payback Chart is not great at capturing seasonal fluctuations in payment behavior. Only a very discerning eye will detect a slight hump in the vintage curves due to tax refunds. At Ensemblex, we generally do one-off analyses to

assess normal seasonal impacts to repayment and adjust projections accordingly. However, we don't have a standard way to assess sudden payment deterioration like what lenders are facing with the current economic crisis.

Introducing the Payment Index Chart

To capture the effects of the current economic shock it is natural to look at delinquency rates. Delinquency rates, of course, will increase. But delinquency rates likely won't capture the whole story. Most lenders have adopted more flexible forbearance policies, which will artificially suppress delinquency rates. Additionally, delinquency rates may not capture the impact of customers who reduce the amount they are paying each period.

We wanted to find a single metric to get a clean read around early payment performance. If payment volumes look good, then all is good; if payment volumes dip, then there's trouble ahead. We developed the Payment Index Chart as the cleanest metric to assess the impact of the current crisis on portfolio performance.

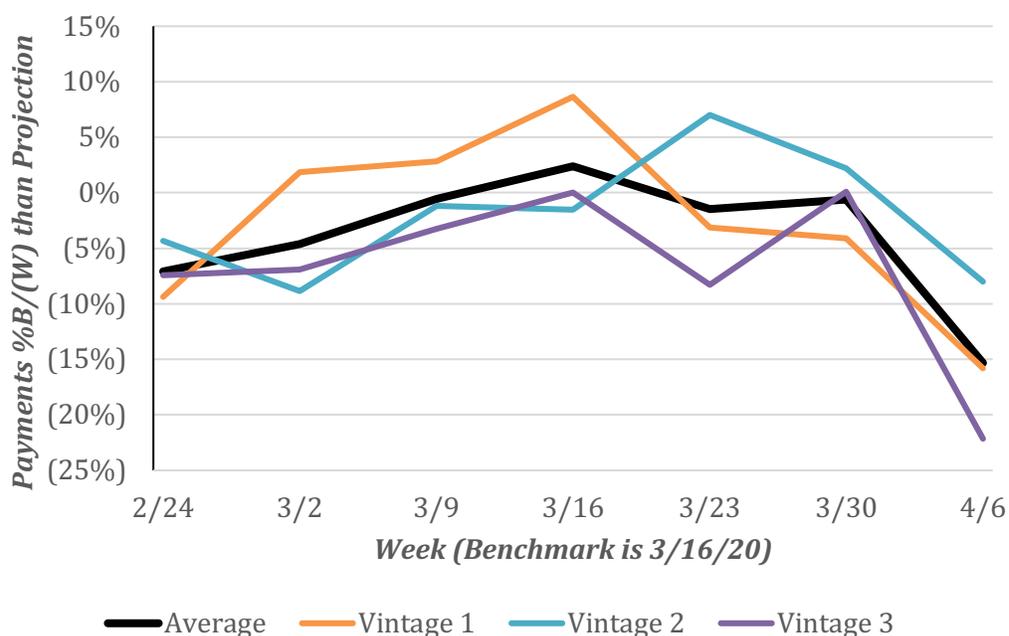
In short, the Payment Index Chart shows the *actual* collected payments relative to *projected* collected payments for all vintages. A value of 10% means that payments came in 10% higher than projected for the given period; a -10% value, means payments were 10% lower than projected. The key is to use the Payback Chart to set payment projections based on performance up to the last period before the crisis. We go into more detail on how to create this chart in the Addendum.

In Figure 2, we created the Payment Index Chart using the same data that we used in . In this case we projected payments based on performance through March 15 because that is when the COVID-19 shelter-in-place orders began to roll out. You can see that payments were within 10% of projections for the first two weeks, the weeks of March 23 and March 30. That is in line with our expectations given that paychecks generally lag work. Customers whose jobs were affected, or lost hours mostly received their normal paychecks through the end of March.

In the most recent week of April 6, we see a very clear payment performance drop. On average, vintages came in 15% below projections. If you look back at the Payback Chart in , you would be very hard pressed to identify the timing or magnitude of the payment shock.

We expect to see a more precipitous drop in the coming weeks, and we will continue to monitor this chart closely throughout the duration of the crisis.

Figure 2 - Payment Index Chart



Modifications for Monthly Payment Products

The great thing about daily and weekly payments is that the feedback loop is very quick. We love this tool for the chance to quickly understand a landscape that is literally changing on a daily basis. Unfortunately, monthly products don't appear to offer the same opportunity to get quick feedback. We believe that we have a solution to that problem.

Most monthly installment products collect payments over the course of the month. Looking at month-to-date numbers is likely to create some distortions because we often observe differences between customers who pay at various times of the month. We can control for that variance by binning the vintages into smaller groups. Most lenders operate twenty statement cycles per month. We recommend creating four bins based on cycle. Every week the chart would compare those binned vintages effectively converting a monthly chart into a weekly chart.

Conclusions

We are all currently working in an environment where our expectations for the next day, week and year are changing daily. The stock market is swinging wildly based on oil prices, mortality rates, and stimulus legislation. At Ensemblex we understand that we are working in an environment where we must rely more heavily on intuition than we would normally like to. However, that doesn't mean we should forego collecting data that can guide our decision making. Our new Payment Index Chart gives us the opportunity to more quickly identify the severity of the current crisis and its impact on portfolios. That insight allows us to make better decisions going forward.

It should also help lenders identify the turn when things start to get better. Lenders who have this kind of data will be better prepared to survive the depth of the crisis and to lead into the recovery.

About Ensemblex

Ensemblex is a boutique professional services firm focused on the lending industry. We are a team of strategic, data-driven credit experts who worked at companies like Capital One, CitiBank, and ZestFinance. Ensemblex offers analytically advanced consulting services and machine learning solutions across the full lending life cycle. We have decades of experience working with companies ranging from leading banks to fintechs across multiple asset classes including credit card, auto, and personal loans. Learn more at www.ensemblex.com.

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Addendum – How to Create the Payment Index Chart

We have attempted to generate a step-by-step set of instructions here. If you have any questions, please reach out to us and we'd be happy to talk you through the process.

Step 1 – Build the Payback Chart

The Payback Chart is relatively straightforward. You should cluster loans by whatever vintage level you find appropriate. For shorter-term loans, we usually use origination month; for longer-term loans we use origination quarter. As mentioned in , longer-term loans may also benefit from binning by cycles. As such, you might have 2018Q4[1-5] for the fourth quarter of 2018, cycles 1 through 5.

Within each vintage you calculate the cumulative total payments made divided by the loan amount extended. That ratio is the payback. For loans that have chained top-ups, we add the top-up amount to the denominator. We then use the vintage level curves to create a target curve. A simple average of the monthly values can get distorted by differences so you will need to find a way to normalize that. In many cases simply using the shape of the oldest vintage and then scaling it the midrange of all vintages works well enough.

We then plot a line for each vintage with the payback on the vertical axis and the periods along the horizontal axis. This is the chart that is shown in .

Frequently the last data points in each vintage will be incomplete. For example, in a quarterly vintage, the last data point will include only one month of data. In that case, you will need to trim the last two periods of performance.

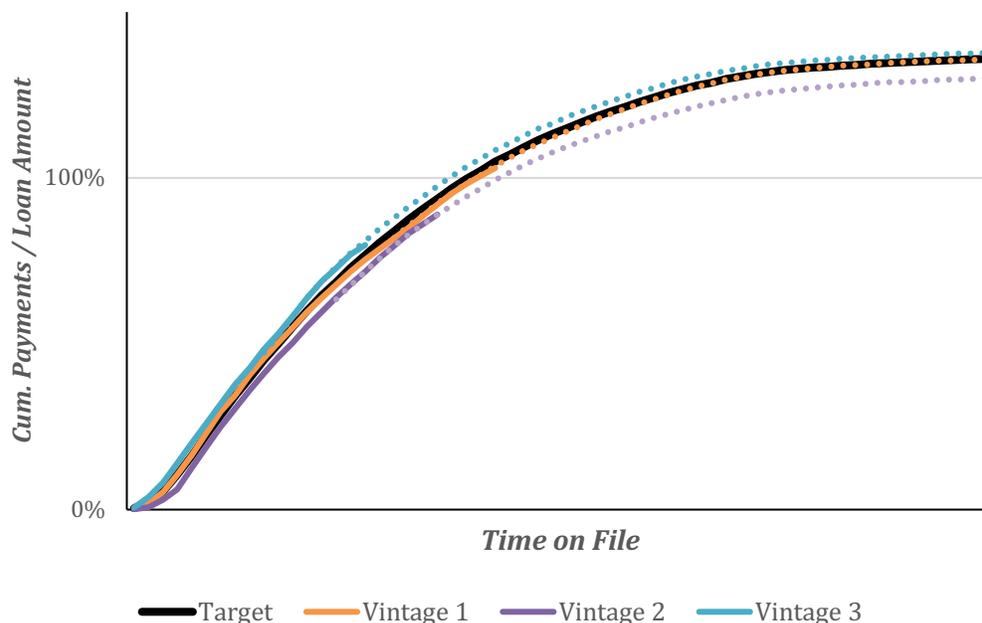
Step 2 – Build the Projections

In general, when we are building out projections, we take the last complete period of each vintage and we scale the target curve to match the payback ratios. The projection from the last actual data point should look like a natural continuation of the actual data to date.

For the purposes of the Payment Index Chart we make a slight, but material change to the normal process. In this case we want to benchmark to a pre-crisis timeframe. For daily or weekly payment process, we would benchmark to 3/15/20. For monthly payment products, we would pin it to February. However, if you are binning cycles, you could bin to the last complete cycle before mid-

March. We then use that benchmark period, instead of the most recent period, to create a projection. The resulting chart is shown in .

Figure 3 - Payback Chart with Projections



For example, if a given vintage had an actual payment ratio of 0.953 at period 23 and the target curve had a payment ratio of 0.968 at period 23, then we would apply a ratio of 0.953/0.968 to all periods of the target curve for period 24 and beyond.

Step 3 – Calculate the Payment Shock

Using the same numbers from above, we’ve created an example in **Error! Reference source not found.** that you may want to refer to as we work through the shock calculation.

As an example, let’s walk through the calculations for Week 3. Remember that the projection got frozen at the benchmark period (Week 0). It projected that our cumulative payment ratio would be 1.009² by Week 2 and 1.036 by Week 3. That

² To be explicit, that was calculated as: current target x benchmark actual / benchmark target; or $1.022 \times 0.953 / 0.968 = 1.009$.

means we projected an increase (or payment) of 0.027 in Week 3. In fact, we saw a cumulative payment ratio of 1.007 in Week 2 and 1.030 in Week 3, an increase of just 0.023. The ratio of the actual to the projection gives us our payment index and by subtracting 1, we get our measure of payment shock. In this case, $0.023 / 0.027 - 1 = -15.8\%$

Table 1 - Example Shock Calculations

Week	Target	Actual	Projection	Shock
-3	0.874	0.850	0.854	
-2	0.906	0.885	0.889	1.87%
-1	0.938	0.921	0.923	2.81%
0	0.968	0.953	0.953	8.65%
1	0.997	0.982	0.983	(3.15%)
2	1.022	1.007	1.009	(4.12%)
3	1.048	1.030	1.036	(15.80%)

We include weeks from before the benchmark so that we can get a sense of the normal volatility for a week. We would recommend looking back about 3-4 periods for weekly and monthly payment products and at least one month for daily payment products.

The final step is to turn that into chart. We again plot a line for each vintage using the payment shock on the vertical axis and the periods along the horizontal axis. This is the chart that is shown in .