March 5, 2014

United States

The Mortgage Analyst

Credit Strategy Research

Short term prepayment forecasting

January's slow prepayment print led to MBS repricing

Conventional MBS prepay speeds declined by 20% in January, a decline which was larger than market expectation, leading to some tightening of premium MBS and IO spreads. This experience raises the question of whether near-term prepayment prints can be predicted with greater accuracy. We look at a number of factors that appear to be useful in short-term prepay forecasting, including lagged refi indices, search engine trends, pending home sales, and seasonality, and find that these factors were pointing to a significant prepayment decline in January.

MBA refinance index has become a more reliable prepay predictor

Since 2010 the MBA refinance application index has had a 97% correlation with conventional prepay prints, suggesting a fairly stabilized relationship between applications and realized refinancings. Internet search trends are less correlated with prepayments than is the refi index, but search trends benefit from being a more leading indicator, and thus can be a useful input in prepay forecasting.

Pending home sales and seasonality predict housing turnover

As refinance rates decline, housing turnover is becoming an increasingly large percentage of overall prepayments. Variables that can be used to forecast turnover include pending home sales, and existing home sales seasonal factors. Housing seasonal factors lead to wide predictable swings in monthly turnover, with ~25% sales declines every year in January, and ~30% increases in home sales in March.

Expect decline in speeds in February, but pickup in March

Accounting for the variables listed above, we would expect speeds to decline a further 15% in February, but accelerate in March, with March prepays gaining an additional 1 CPR from housing turnover seasonals.

Charles P. Himmelberg
(917) 343-3218 charles.himmelberg@gs.com
Goldman, Sachs & Co.

Marty Young
(917) 343-3214 marty.young@gs.com
Goldman, Sachs & Co.

Hui Shan
(212) 902-4447 hui.shan@gs.com
Goldman, Sachs & Co.

Short term prepay forecasting helpful for tactical positioning

Long-horizon investors in mortgage backed securities (MBS) need to account for borrower prepayment behavior over a thirty-year horizon across a range of future interest rate scenarios in order to evaluate MBS fundamental risks and returns. In comparison to this problem of projecting thirty years of prepayment rates, a much narrower but still challenging problem is the trader's problem of forecasting prepays over just the next one or two months. While a one-month prepay forecast is inadequate for evaluation of mortgage yields, the short-term prediction can be useful in tactical positioning. Unlike in the case of the 30-year forecast, the one-month-ahead prepay prediction can potentially take account of multiple contemporaneous variables including mortgage applications surveys, internet search measures, and housing data releases, to help refine the forecast.

Here, we evaluate the predictive value of these measures for short-term forecasting. We find that the MBA refinance applications index has developed a stabilized relationship with actual realized prepayments, and that use of the applications series can improve short-term forecast accuracy relative to a model using mortgage rates alone. We also find predictive value in measures of internet search trends (looking at searches for keywords such as "refinance" or "mortgage rates").

As the mortgage market becomes increasingly out-of-the-money for refinancing, however, such refinance-related variables may have less predictive value than have they had in the past. We look at variables that help predict purchase rather than refinance activity, and find that pending home sales and housing seasonal factors can be helpful in anticipating short-term movements in housing turnover.

Leading indicators of mortgage refinance rates

Refi applications index has been an accurate predictor of prepays

A refinance applications index should, in principal, be a useful leading indicator of future realized prepayments, as every mortgage refinancing event must be preceded by a loan application. The correspondence between an applications index and actual realized prepays could be imperfect, however, if the pull-through ratio between applications and actual loan closings varies over time, or if the applications survey population is unrepresentative of the full lender population. Exhibit 1 shows that for the past several years the MBA refinance applications survey index has provided a very accurate indication of actual prepayment speeds. The recent accuracy of the refi index in anticipating prepays is likely a reflection of the increased coverage of the survey (now capturing around 75% of retail channel volume, up from 50%[1]), combined with relative stability in underwriting standards and hence pull-through rates.

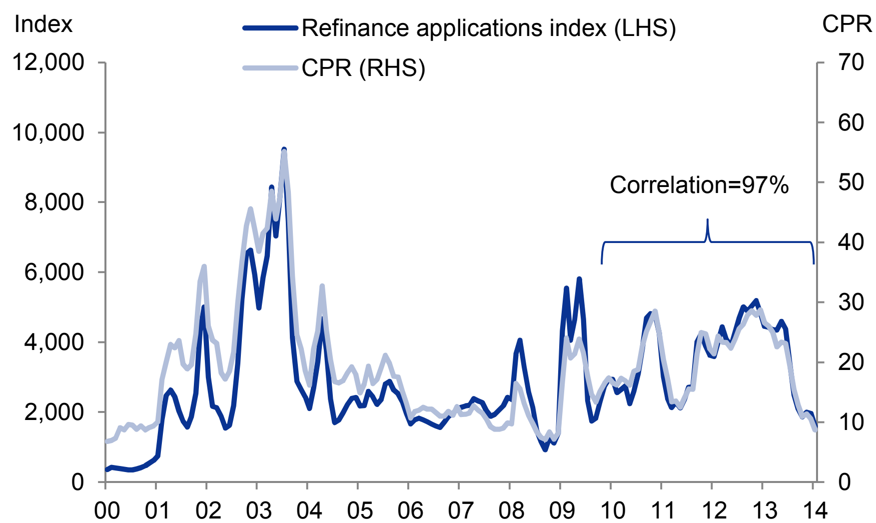
In Exhibit 1, the refi index is shown as a 70%/30% combination of the 1-month and 2-month lags, relative to the date of the prepayment. That is, the January 2014 data value measures (70%)(average weekly data during December 2013) + (30%)(average weekly data during November 2013). These weights are a reflection of the typical range of lags between mortgage application and final mortgage refinancing.

A traditional mortgage prepay model predicts refinance changes based on interest rates, rather than through use of a refinance applications index. We find that day-count adjusted

[1] "MBS Weekly Applications Survey Methodology", http://www.mbaa.org/files/Research/HistoricalWAS/WASMethodology.pdf.

prepay rate changes has a reasonably close correspondence with mortgage rate changes (R^2=59.7% from 2010 to 2014), but a much higher correlation with lagged change in refinance index (R^2=78.9%). In particular, a model based on the refi index does a better job of anticipating the January 2014 prepayment slowdown.

Exhibit 1: The MBA refinance applications index has been highly correlated with actual realized prepay rates
Aggregate conventional day-count adjusted mortgage prepayment rates vs. lagged MBA conventional refinance applications index

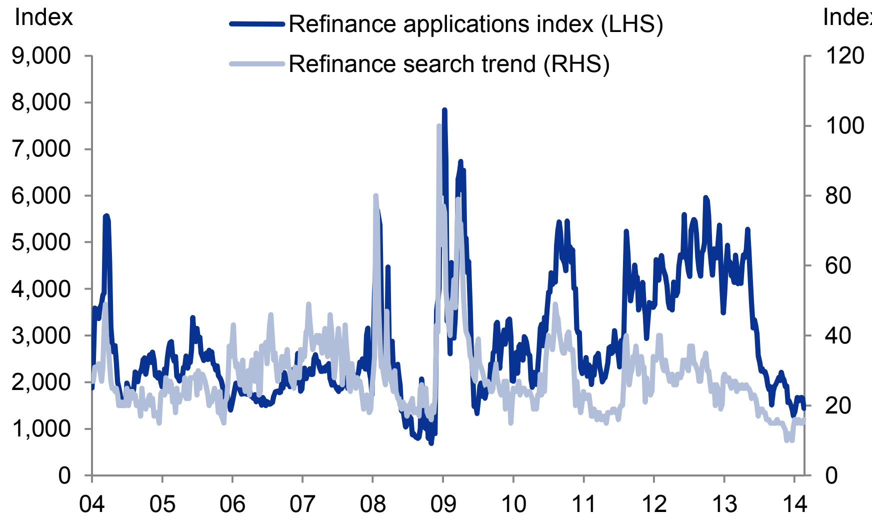


Source: MBA and Goldman Sachs Global Investment Research

Internet search leads mortgage applications, which leads prepays

Another potential near-term indicator for prepayment speeds is the internet search intensity for search terms such as “mortgage refinance”, “mortgage rates”, or “refinance calculator”. Exhibit 2, for example, compares the MBA refinance applications index with a series measuring searches for the term “refinance mortgage”. The series are generally consistent, though the search measure tends to lead the applications measure by one or two weeks. We have observed a tradeoff: the refi applications index is more tightly correlated with actual prepays than are internet search measures, but the search measure is slightly more timely.

Exhibit 2: Internet refinance search volume leads mortgage applications by one to two weeks
Weekly internet search volume for "refinance mortgage" vs. weekly refinance applications index



Source: Google, MBA, Goldman Sachs Global Investment Research

Housing turnover predicted by seasonals, pending home sales

Exhibit 1 suggests that the refinance applications index alone is a strong predictor of overall prepayment rates; this has been the case because for the past several years, month-to-month changes in prepays have been dominated by changes in refinance rates. As we move into a purchase mortgage environment, however, total prepayments for many cohorts will be driven more by housing turnover (i.e., borrowers selling their home and moving) rather than by refinancing. Thus, it is useful to identify leading indicators or predictable patterns of home sales in addition to home refinancings. Here, we examine two such factors: home sales seasonality, and the pending home sales measure.

Short-term housing turnover trends dominated by seasonality

Over a short horizon, variation in home sales is dominated by seasonal patterns. Exhibit 3 shows the existing home sales series; there are wide swings from month to month, reflecting the tendency of home sales to cluster in the spring and summer. The largest month-to-month changes occur in January (when sales typically decline by 25%) and in March (when sales typically increase by 35%). This seasonal pattern helps explain the latest slowdown in prepay speeds for cohorts like the 30-year 3% coupons from 2012, which declined from 3.8 CPR in December to 3.1 CPR in January. The pattern also suggests that the decline in turnover speeds seen last month should be reversed, not in the February print, but in the subsequent March prepay data, if the traditional seasonal pattern is followed.

Exhibit 3: Existing home sales are strongly seasonal
Non-seasonally adjusted existing home sales, annualized

Source: NAR

Pending home sales lead actual home sales

The seasonal pattern of home sales is regular, but does have some variation: for example, home sales fell by 27% in January 2014, but by only 22% in January 2013. A series that can help further refine short term turnover forecasts is the Pending Home Sales index. This series measures housing contract activity, and thus leads actual sales by one or two months. Exhibit 4 shows the lead-lag relationship between the pending and existing home sales series. The latest pickup in the pending home sales index points to growth in actual housing turnover in the coming months.

Exhibit 4: The pending home sales index leads the existing home sales index by one month
Non-seasonally-adjusted pending vs. existing home sales indices

Source: NAR

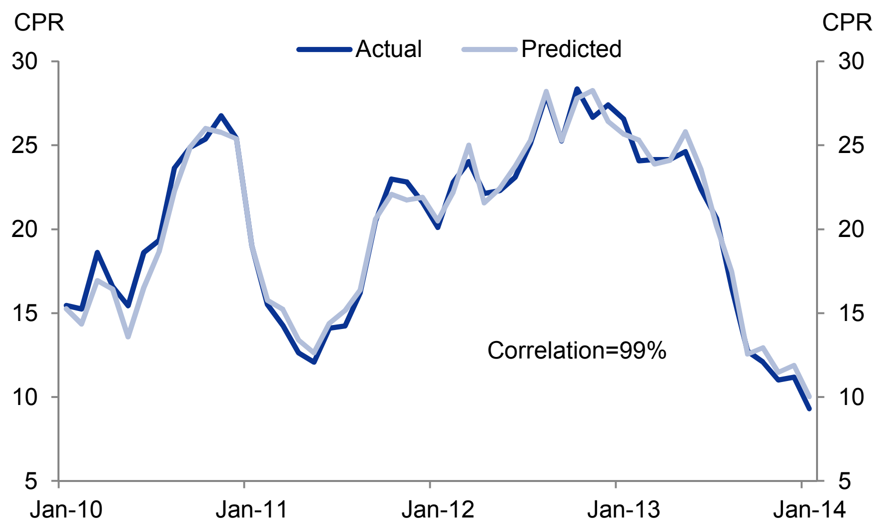
Short-term outlook for prepays: slower in February, faster in March

Taking the above factors into account, what should we expect for the next two data tapes? Exhibit 5 shows the historical correspondence between conventional prepay rates and a simple forecast based on lagged refinance applications index, lagged prepayment, day count, and housing seasonals. Extrapolating this model out into February and March suggests speeds will decline further in February on the lower day count. January aggregate conventional speeds were 9 CPR; prepays should be down roughly 15% from January to February. However, from January to March, speeds on low coupon cohorts should be up 1 CPR or more on improved housing turnover seasonals.

Can short-term prepay forecasts be refined further, through additional data inputs? The answer is likely yes, though the incremental value of each new variable might decline as more factors get added to the forecast equation. Additional inputs to a forecast could include credit bureau data (e.g., measures of credit inquiries made by lenders) and housing realty data (e.g., numbers of listings and average days on market). While these inputs will have limited value in projecting thirty-year lifetime mortgage cash flows, they could help further reduce the possibility of short term prepay tape surprises.

Marty Young, Hui Shan and Charlie Himmelberg

Exhibit 5: Short term prepayments can be predicted by refinance applications index plus housing turnover seasonals
Predicted vs. actual aggregate conventional prepayment rates



Source: eMBS and Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Charles P. Himmelberg, Marty Young and Hui Shan, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Disclosures

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs usually makes a market in fixed income securities of issuers discussed in this report and usually deals as a principal in these securities.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. **Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director, advisory board member or employee of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman, Sachs & Co. and therefore may not be subject to NASD Rule 2711/NYSE Rules 472 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of the Global Investment Research Division of Goldman Sachs Australia may attend site visits and other meetings hosted by the issuers the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. **Brazil:** Disclosure information in relation to CVM Instruction 483 is available at http://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 16 of CVM Instruction 483, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** Goldman Sachs Canada Inc. is an affiliate of The Goldman Sachs Group Inc. and therefore is included in the company specific disclosures relating to Goldman Sachs (as defined above). Goldman Sachs Canada Inc. has approved of, and agreed to take responsibility for, this research report in Canada if and to the extent that Goldman Sachs Canada Inc. disseminates this research report to its clients. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited. **Japan:** See below. **Korea:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. **Singapore:** Further information on the covered companies referred to in this research may be obtained from Goldman Sachs (Singapore) Pte. (Company Number: 198602165W). **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union: Disclosure information in relation to Article 4 (1) (d) and Article 6 (2) of the European Commission Directive 2003/126/EC is available at http://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan and Type II Financial Instruments Firms Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Ratings, coverage groups and views and related definitions

Credit Research assigns ratings to designated on-the-run ("OTR") debt securities of issuing companies. **Definitions of Ratings: OP = Outperform.** We expect the total return to outperform the median total return for the analyst's coverage group over the next 6 months. **IL = In-Line.** We expect the total return to perform in line with the median total return for the analyst's coverage group over the next 6 months. **U = Underperform.** We expect the total return to underperform the median total return for the analyst's coverage group over the next 6 months.

NR = Not Rated. The investment rating, if any, has been removed pursuant to Goldman Sachs policy when to Goldman Sachs is acting in an advisory capacity in a merger or strategic transaction involving this company and in certain other circumstances. **NC = Not Covered.** Goldman Sachs does not cover this company. **RS = Rating Suspended.** Goldman Sachs Research has suspended the investment rating for this credit, because there is not a sufficient fundamental basis for determining, or there are legal, regulatory or policy constraints around publishing, an investment rating. The previous investment rating is no longer in effect for this credit and should not be relied upon. **CS = Coverage Suspended.** Goldman Sachs has suspended coverage of this company. **NA = Not Available or Not Applicable.** The information is not available for display or is not applicable.

Coverage views: The coverage view represents each analyst's or analyst team's investment outlook on his/her/their coverage group(s). The coverage view will consist of one of the following designations: **Attractive (A).** The investment outlook over the following 6 months is favorable relative to the coverage group's historical fundamentals and/or valuation. **Neutral (N).** The investment outlook over the following 6 months is neutral relative to the coverage group's historical fundamentals and/or valuation. **Cautious (C).** The investment outlook over the following 6 months is unfavorable relative to the coverage group's historical fundamentals and/or valuation.

Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce equity research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; in Canada by either Goldman Sachs Canada Inc. or Goldman, Sachs & Co.; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman, Sachs & Co. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom and European Union.

European Union: Goldman Sachs International authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority, has approved this research in connection with its distribution in the European Union and United Kingdom; Goldman Sachs AG and Goldman Sachs International Zweigniederlassung Frankfurt, regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht, may also distribute research in Germany.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by our Global Investment Research Division. Goldman, Sachs & Co., the United States broker dealer, is a member of SIPC (http://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and our proprietary trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, our proprietary trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

We and our affiliates, officers, directors, and employees, excluding equity and credit analysts, will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research.

Any trading recommendation in this research relating to a security or multiple securities within an industry or sector is reflective of the investment theme being discussed and is not a recommendation of any such security in isolation.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options disclosure documents which are available from Goldman Sachs sales representatives or at http://www.theocc.com/about/publications/character-risks.jsp. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research or data available on a particular security, please contact your sales representative or go to http://360.gs.com.

Disclosure information is also available at http://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.