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Mitigating financial fragility with Continuous Workout Mortgages☆

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ABSTRACT

This paper models Continuous Workout Mortgages (CWMs) in an economic environment with refinancings and prepayments. CWMs are home loans whose balance and payments are indexed using a market-observable house price index of the pertaining locality. Our main results include: (a) explicit modelling of repayment and interest-only CWMs; (b) closed form formula for mortgage payment and mortgage balance of a repayment CWM; (c) a closed form formula for the actuarially fair mortgage rate of an interest-only CWM. For repayment CWMs we extend our analysis to include two negotiable parameters: adjustable "workout proportion" and adjustable "workout threshold." These results are of importance as they not only help in the understanding of the mechanics of CWMs and estimating key contract parameters, but they also provide insight on how to enhance the resilience of the financial architecture and mitigate systemic risk.

> *The U.S. financial system is in tatters. It is time to build from scratch.*
> Dennis K. Berman (2008, p. 19)

The ongoing financial crisis has exposed the vulnerability of the most sophisticated financial structures to systemic risk. This crisis – emanating from mortgages to borrowers with high credit risk – has devastated the capital base of financial intermediaries on both sides of the Atlantic. Its impact on the real sector of the economy has given rise to fear and uncertainty not seen since the Great Depression of the 1930s (see Reinhart and Rogoff, 2008; Diamond and Rajan, 2008).

The fragility of the financial intermediaries stems from the rigidity of the traditional mortgage contracts such as the Fixed Rate Mortgages (FRMs), Adjustable Rate Mortgages (ARMs) and their hybrids (see Stiglitz, 1988; Campbell and Cocco,

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2003; Green and Wachter, 2005; Reinhart and Rogoff, 2008). Modigliani (1974, p. 1) reiterates this quite strongly when he states that: *"As long as loan contracts are expressed in conventional nominal terms, a high and variable rate of inflation – or more precisely a significant degree of uncertainty about the future of the price level – can play havoc with financial markets and interfere seriously with the efficient allocation of the flow of saving and the stock of capital."* In order to make it more resilient and mitigate systemic risk, this necessitates reforming the financial architecture to include facilities that can better absorb shocks in the financial system.

One such solution studied in this paper is that of Continuous Workout Mortgages (CWMs) as expounded in Shiller (2008a,b, 2009b), Shiller et al. (2011) and Feldstein (2009). This facility eliminates the expensive workout of a defaulting rigid plain vanilla mortgage contract. This subsequently reduces the risk exposure of financial institutions and thus the government to their bailouts. CWMs share the price risk of a home with the lender and thus provide automatic adjustments for changes in home prices or incomes. Mortgage balances are thus adjusted and monthly payments are varied automatically with changing home prices. This feature eliminates the rational incentive to exercise the costly option to default which is embedded in the loan contract. Despite sharing the underlying risk, the lender continues to receive an uninterrupted stream of monthly payments. Moreover, this can occur without multiple and costly negotiations.

Unfortunately, prior to the current crisis CWMs have rarely been considered. The academic literature, with the exception of Ambrose and Buttimer (2012), has not discussed its mechanics and especially its design. Shiller is the first researcher, who forcefully articulates the exigency of its employment. CWMs were conceived in his (2008b) and (2009b) studies[1] as an extension of the well-known Price-Level Adjusted Mortgages (PLAMs), where the mortgage contract adjusts to a narrow index of local home prices instead of a broad index of consumer prices. In their recent study, Ambrose and Buttimer (2012) numerically investigate properties of Adjustable Balance Mortgages which bear many similarities to CWMs. Alternatively, Duarte and McManus (2011) stipulate creation of derivative instruments written on credit losses of a reference mortgage pool. Our simple and fully analytic model complements the more intricate one of Ambrose and Buttimer (2012). We rely on a methodology which allows valuation of optional continuous flows (see e.g. Carr et al., 2000; Shackleton and Wojakowski, 2007).

For lenders to hedge risks, Continuous Workout Mortgages need indicators and markets for home prices and incomes. These markets and instruments already exist.[2] For example, the Chicago Mercantile Exchange (CME) offers options and futures on single-family home prices. An example of this are the Real Estate MacroShares launched on NYSE in May 2009. Furthermore, reduction of moral hazard incentives requires inclusion of the home-price index of the neighborhood into monthly payment formula. This is to prevent moral hazard stemming from an individual failing to maintain or, worse, damaging the property just to reduce mortgage payments. Likewise, occupational income indicators matter along with the borrower's actual income. This is again to prevent moral hazard stemming from an individual deliberately losing a job just to reduce mortgage payments.

We feel that CWMs retain the positive attribute of PLAMs in reducing purchasing power risk (see Leeds, 1993). They, however, improve upon PLAMs by reducing prepayment, default and interest rate risks, since the borrower shares in the risk of the housing market. This implies that borrowers participate in the appreciation of the property during any positive economic event such as an interest rate decrease, which compensates prepayment risk. Nonetheless, borrowers participate in the depreciation of the property during any negative economic event, thereby reducing default risk. This is because a CWM aims to prevent the mortgage balance exceeding the value of the property, thus keeping the embedded default option (at or) out of the money at all times. Therefore, during the tenure of a mortgage which is comprised of periods of varying economic cycles (including changing interest rates) CWMs are anticipated to defray associated risks. The only risk which CWMs (like PLAMs) currently cannot cure is liquidity risk. This, however, can be expected to reduce over time by their securitization and eventual deployment (in sufficient volume).

We implicitly assume the existence of an information infrastructure, where property rights, foreclosure procedures (needed for real estate to serve as collateral) and accurate methods of valuing property are well established (see Levine et al., 2000). This assumption facilitates the underwriting of mortgages in a complete market setting, where contracts spanning each state of the economy are clearly and unambiguously written. This presumes that information costs are not very acute in real estate finance for the following reason. Real estate lenders (the principals in a debt contract) can costlessly decipher any proprietary (ex ante) information held by borrowers (the agents in a debt contract) by trading financial claims over a multi-period horizon. This is deduced from the literature on multi-period insurance contracting (see Hosios and Peters, 1989). In the "real world," lenders also have access to information on ex post risk and return on various classes of properties to help them underwrite their facilities appropriately.[3]

[1] See Shiller (2003) for home equity insurance.

[2] Creation of new markets for large macroeconomic risks is discussed in Shiller (1993). For derivatives markets for home prices see Shiller (2009a).

[3] The above assumption does not imply that the financial intermediaries are unaware of dangers posed by the twin issues stemming from information asymmetry (i.e. adverse selection and moral hazard). These intermediaries have to be extra vigilant in case of CWMs as they share in the risk of the underlying collateral (i.e. the home). This necessitates the careful structuring of the mortgages to mitigate both issues as follows: (1) adverse selection is alleviated by releasing funds in the escrow process when the title of the specific property being purchased is exchanged for cash; (2) moral hazard is dissipated dynamically as advocated in Pagès (2009). This is conducted by continuously monitoring the borrower (and the underlying collateral) in conjunction with mandating the following in the mortgage covenant: (i) minimum maintenance on the property; (ii) payment of taxes; and (iii) adequate insurance coverage. See Smith and Warner (1979) for more information on debt contracting using covenants.