



Global imbalances, cross-market linkages, and the financial crisis: A multivariate Markov-switching analysis

Julien Chevallier *

University Paris Dauphine (CGEMP/LEDA), Place du Marechal de Lattre de Tassigny, Paris, 75775 Cedex 16, France

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ABSTRACT

Based on multivariate Markov-switching models, this paper presents new results on the interactions between global imbalances, credit spreads, housing markets, macroeconomic variables, commodities and equities during Q1-1987/Q1-2011. We show that rising global imbalances and the uncontrolled development of the US mortgage and housing markets have been deeply destabilizing the economy, with various shocks impacting subsequently equity markets and macroeconomic variables. But we also uncover, surprisingly, that the cross-market linkages with the commodity markets are strong. Finally, we identify that the US housing market lies at the epicenter of the crisis through its multiple and highly significant interactions with the other variables in the system (including the global imbalances). Sub-samples and alternative time series estimates are provided to check the statistical congruency of the various models.

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1. Introduction

The AA+ downgrade of US debt by Standard & Poor's, stemming from the increasing default risk of US Treasury securities due to the financial crisis (Nippani and Smith, 2010), came nonetheless to much surprise for many market observers in August 2011. This situation may be viewed as the consequence of the buildup in global imbalances¹ and the financial fragility of the US economy (Blanchard et al., 2005; Caballero et al., 2006; Gennaioli et al., forthcoming; Gruber and Kamin, 2007; Obstfeld and Rogoff, 2005). As Caballero and Krishnamurthy (2009) put it, the crisis was triggered by the crash in the real estate bubble and amplified by the extreme concentration of risk in a highly leveraged financial sector.² The boom in US

assets was especially apparent in the housing sector, facilitated by low interest rates and sophisticated structured credit instruments. From the bailout of Bear Stearns' hedge funds in June 2007 to the bankruptcy of Lehman Brothers in September 2008, the crisis was contained in the financial sector. However, as the securitization industry froze and US credit markets weakened, emerging countries and commodity producers were looking for alternative investment vehicles, which took the form of US Treasuries and commodity markets. The evolution of the West Texas Intermediate (WTI) crude oil futures price during July–October 2008 can be understood as the formation of a new commodity bubble (Daskalaki and Skiadopoulos, 2011). In this context, we can also expect flight-to-quality³ episodes such as a rush to gold (which provide little services but safe value, see Baur and McDermott (2010), Beaudry et al. (2011)). These analyses are now well-known (Brunnermeier, 2009; Cornett et al., 2011; Duchin et al., 2010; Gorton and Metrick, forthcoming; Greenspan, 2010; Ivashina and Scharfstein, 2010; Stulz, 2010).

The transmission of the US subprime mortgage crisis to the global economy is somewhat more difficult to analyze. Mishkin (2011) recalls the succession of events going from the AIG collapse, the run on the Reserve Primary Fund, to the Troubled Asset Relief Program

* Tel.: +33 1 44 05 44 64; fax: +33 1 44 05 44 84.

E-mail address: julien.chevallier@dauphine.fr.

¹ Global imbalances refer to three key characteristics: the persistent US trade and current account deficits since the early 1990s, the long-run decline in real interest rates, and the rise of US assets in global portfolios over the last decade (see Caballero et al., 2008a; Cooper, 2008; Cova et al., 2009; Feldstein, 2008).

² Since the emerging market crises at the end of the 1990s, the US has indeed experienced large foreign capital inflows to store value, especially in safe debt investments. In creating safe assets, US financial institutions took on more leverage, but also sourced subprime loans that carried higher cash flow risks. See also Gerardi et al. (2008), Makin and Narayan (2008), Devereux and Yetman (2010), Acharya and Viswanathan (2011).

³ For formal definitions, see Caballero and Krishnamurthy (2008), Naes et al. (2011).

(TARP) bailouts in September–October 2008.⁴ Then, the author summarizes the various steps linking the financial crisis to the recession: (i) the financial crisis widens credit spreads, calling for an unconventional monetary policy, (ii) the decline in asset prices causes the decline in the value of collateral, which freezes the credit channel, and (iii) the uncertainty hinders the ability of financial markets to allocate funds to households and businesses for productive use. Therefore, we can identify significant sources of US spillovers to the world economy through house and stock price dynamics, the credit channel, and a rebalancing of international investors' portfolios (Bagliano and Morana, 2012). As Krishnamurthy (2010) puts it, the financial crisis began in debt markets: while stock markets were still peaking in October 2007 and until August 2008, debt markets (with mortgage-backed securities) had been in full swing since August 2007. Stock markets adjusted later on, between late 2008 until March 2009. Therefore, a full characterization of how the financial crisis has been spreading to the global economy needs to rely on the analysis of debt markets. Besides, we will focus our analysis on the US housing market. Although Musso et al. (2011) recognize that there is still controversy about the precise mechanism through which the correction of US housing prices triggered the recession, it is clear that the US housing market has been at the epicenter of the crisis. The evolution of house prices and the behavior of the mortgage credit market appear therefore at the heart of our research question (Chor and Manova, forthcoming). Campello et al. (2010) reveal that credit-constrained firms in the US, Europe and Asia planned deep cuts in tech spending, unemployment, and capital spending, while canceling or postponing their planned investments. Chor and Manova (forthcoming) show that credit conditions were an important channel through which the crisis affected trade volumes, by exploiting the variation in the cost of capital across countries and over time, as well as the variation in financial vulnerability across sectors. Finally, the transmission of shocks to the global economy has also been documented through the stock prices of US and foreign firms (Ammer et al., 2010).

In this paper, we seek to show that the global imbalances, the sub-primes crisis, the evolution of macroeconomic variables and commodity markets are tightly interconnected, as emerging countries (Asia in particular), a subpart of continental Europe investors, and commodity producers have progressively stored their wealth on the US financial markets. That is to say, we wish to identify econometrically the existence of cross-market linkages, and the channels through which they operate. Against this background, the use of Markov-switching models is typically justified by the alternance between periods of economic expansion and recession during the study period. Indeed, the interesting property of the Markov-switching model as designed by Hamilton (1989) lies in its ability to capture the underlying 'boom–bust' economic cycle. Through the use of transition probabilities, the econometrician is able to infer in which regime the process is at each point in time, depending on the set of autoregressive parameters and the unobserved state variable (i.e. the state of the economy). Based on multivariate Markov-switching models, the central research question tackled in this paper is stated as follows: *how can we assess the interconnectedness of financial markets, commodity markets and other asset classes (real estate, etc.) in the context of global imbalances revealed by the financial crisis?*

Concerning the role played by the global imbalances in leading to the current financial crisis, different views have been expressed in previous literature. As Obstfeld and Rogoff (2009) put it, controversy remains about the precise connection between global imbalances and

the global financial meltdown. Some commentators argue that external imbalances had little or nothing to do with the crisis, which instead was the result of financial regulatory failures and policy errors, mainly on the part of the U.S. Others put forward various mechanisms through which global imbalances are claimed to have played a prime role in causing the financial collapse. In an equilibrium model, Caballero and Krishnamurthy (2009) did *not* find that the root cause was global imbalances but a safe-asset imbalance. In the structural VAR framework, Nishigaki (2009) argues that the size of the US current account deficit threatens the world economy. In this context, the expansion of foreign economies would be required to reduce global imbalances without a global recession. Based on the panel-regression approach, Gruber and Kamin (2009) find that higher current account balances are associated with higher per capita incomes, higher fiscal balances, more net foreign assets, fewer young or aged dependents, and higher net oil exports. By applying the heterogeneous panel cointegration method, Chiu et al. (2010) find that a long-run negative relationship exists between the real exchange rate and the bilateral trade balance for the US. In a factor autoregressive framework, Bagliano and Morana (2012) show that the US current account deficit contributed to the boom of the credit market and debt accumulation, hence creating favorable conditions for the financial crisis to occur. In a least-squares regression framework, Lane and Milesi-Ferretti (2011) find a strong link between pre-crisis domestic financial factors (fast private credit growth) and external imbalances. They identify external vulnerabilities (such as large current account deficits) and domestic credit booms as factors explaining the likelihood of the crisis. However, they fail to establish the mechanisms by which these variables may have affected macroeconomic outcomes.

With respect to cross-market linkages, Caballero et al. (2008b) show by means of simulations that the collapse in the US housing market and the contraction in credit markets played a significant role in explaining the surge in commodity prices that followed the subprime crisis. In addition, they report that commodity prices are extremely sensitive to the growth slowdown and the drop in financial wealth. Chan et al. (2011) use a general Markov-switching model to examine the relationships between the returns of financial, commodities and real estate assets. Their results show evidence of flight to quality (flight from quality) during periods of economic recession (expansion). This topic is also closely related to the literature on financial contagion. In a vector autoregression framework, Longstaff (2010) supports the hypothesis that financial contagion was propagated primarily through liquidity and risk-premium channels. By using copula functions, Aloui et al. (2011) show strong evidence of dependence between Brazil, Russia, India, China (BRIC) and the US, with stronger effects for commodity-price dependent markets than for finished-product export-oriented markets. Based on Bekaert et al. (2005)'s contagion model, Baur (forthcoming) finds that the crisis led to an increased co-movement of returns among financial sector shocks across countries and between financial sector shocks and real economy shocks.

In this paper, we further investigate these questions by resorting to the class of multivariate Markov-switching models. We first study the data on global imbalances, macroeconomic indicators and commodities in univariate Markov-switching models. Then, we explore the links between these variables in a multivariate Markov-switching environment. This econometric framework appears indeed appropriate to capture the relationships between state-dependent variables, which vary nonlinearly with respect to the underlying business-cycle (Hamilton, 1989). For instance, it has been used recently by Al-Anaswah and Wilfling (2011) to detect speculative bubbles in stock-price data, by Alexander and Kaeck (2008) to study the regime-specific behavior of credit default swap spreads, by Alizadeh et al. (2008) to examine the hedging performance in the oil futures markets, by Baba and Sakurai (2011) to study the cross-currency

⁴ Between March and September 2008, eight major US financial institutions failed (Bear Stearns, IndyMac, Fannie Mae, Freddie Mac, Lehman Brothers, AIG, Washington Mutual, and Wachovia). More than 20 European banks, across 10 countries, were rescued from July 2007 to February 2009.

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