The Spanish Review of Financial Economics 14 (2016) 5–14

The Spanish Review of Financial Economics

www.elsevier.es/srfe

Article

Systemic liquidity risk and portfolio theory: An application to the Italian financial markets

Eleonora Iachini [a], Stefano Nobili [b,*]

[a] Bank of Italy – Market and Payment System Oversight, Italy
[b] Bank of Italy – Market Operations, Italy

ARTICLE INFO

Article history:
Received 3 December 2015
Accepted 15 December 2015
Available online 2 March 2016

JEL classification:
G01
G10
G20

Keywords:
Financial crisis
Liquidity risk
Systemic risk
Stress index
Multivariate GARCH

ABSTRACT

This paper introduces a coincident indicator of systemic liquidity risk in the Italian financial markets. In order to take account of the systemic dimension of liquidity stress, standard portfolio theory is used. Three sub-indices, that reflect liquidity stress in specific market segments, are aggregated in the systemic liquidity risk indicator in the same way as individual risks are aggregated in order to quantify overall portfolio risk. The aggregation takes account of the time-varying cross-correlations between the sub-indices, using a multivariate GARCH approach. This is able to capture abrupt changes in the correlations. We evaluate the indicator on its ability to match the results of a survey conducted among financial market experts to determine the most liquidity stressful events for the Italian financial markets. The results show that the systemic liquidity risk indicator accurately identifies events characterized by high systemic risk.

1. Introduction

The financial crisis has underscored the importance of timely and effective measures of systemic risk. Academics, central banks and international organizations are currently devoting much time and effort to developing tools and models which can be of help in monitoring, identifying and assessing potential threats to the stability of the financial system. This paper contributes to this strand of the literature by introducing an indicator of systemic liquidity risk in the Italian financial markets.[1]

In this regard the recent financial crisis has shown that market liquidity can suddenly deteriorate dramatically. Liquidity changes over time for individual securities and for the market overall. As pointed out by Amihud et al. (2013), liquidity varies for a number of reasons. First, it depends in part on the transparency of information about a security's value, which can change over time. Second, the number of liquidity providers and their access to capital is an important determinant of liquidity as argued by Brunnermeier and Pedersen (2009). When liquidity providers (such as banks, market makers, trading firms and hedge funds) lose capital and their access to securitized funding is constrained, as in 2008, they provide less liquidity as their risk aversion increases. Consequently, market liquidity drops simultaneously for most securities and market segments.

Liquidity can also suddenly dry up because of externalities. The willingness to trade by the sell-side facilitates trading for investors (the buy-side) and, consequently, potentially improves market liquidity. It stands to reason that a decreased willingness to trade reduces market liquidity and, if persistent, can exacerbate the liquidity shortfall in the market by triggering a downward spiral that will affect asset prices and thus increase risk aversion. In addition, increased uncertainty makes the provision of liquidity riskier and increases the reward that liquidity providers demand, that is, the cost of trading increases.

In order to address some of these issues, this paper introduces an indicator of liquidity stress using data on the Italian financial markets. The main aim of stress indices is to measure the current level of frictions and strains (or their absence) in the financial system and to summarize it in a single statistic. The proposed indicator is a coincident risk indicator which permits the real-time monitoring and assessment of the stress level in the financial markets. Schwaab

* Corresponding author.
E-mail addresses: eleonora.iachini@bancaditalia.it (E. Iachini), stefano.nobili@bancaditalia.it (S. Nobili).

[1] Any views expressed in this paper are the authors' and do not necessarily represent those of the Bank of Italy.

http://dx.doi.org/10.1016/j.srfe.2015.12.001
2173-1268/

et al. (2011) use a very appropriate metaphor to describe this type of indicator: they call it "a thermometer" that policy makers can plug into the financial system to read its heat.

This paper draws from the analysis developed by central banks and academics in order to identify suitable measures for a composite indicator of the liquidity conditions in the financial markets. In this regard, a composite metric to capture key elements of patterns in financial market liquidity can be constructed by combining information on market liquidity dimensions (i.e. tightness, depth and resiliency as well as estimates of liquidity premiums and asset return volatilities) across several markets.

For this purpose, ten homogenized liquidity stress measures are selected and grouped into three sub-indices representing the most important segments of the Italian financial markets: the equity and corporate market, the government bond market and the money market.

An important feature of the proposed indicator is its focus on the systemic dimension of liquidity stress. A situation of liquidity stress is systemic when it prevails in several market segments at the same time, capturing the idea that liquidity stress is more systemic and thus more dangerous for the entire economy if the drying up of liquidity spreads more widely across the whole financial system. The more a situation of liquidity shortage is systemic, the more a liquidity crisis is likely to occur.

A liquidity crisis is a situation "where market liquidity drops dramatically as dealers widen bid-ask spreads, take the phone off the hook, or close down operations as their trading houses run out of cash and take their money off the table, security prices drop sharply, and volatility increases" (Amihud et al., 2013).

Brunnermeier and Pedersen (2009) and Brunnermeier (2009) provide a theory explaining the origins and underlying dynamics that drive a liquidity crisis. A key insight of their papers is that market liquidity interacts with funding liquidity and that this interaction creates liquidity spirals. The authors show that such liquidity spirals induce fragility in the financial system, because a shock to one market can have a disproportionate effect as the spiral spreads throughout the financial system, affecting other markets.

In order to take account of the systemic dimension of liquidity stress, the indicator proposed in this paper uses a specific statistical design which is shaped according to the standard definitions of systemic risk. It is based on the proposition of Hollò et al. (2012) to analyze the systemic nature of stress considering the time-varying cross-correlations between different stress components corresponding to different market segments of the financial system. In particular, these authors apply insights from standard portfolio theory to the aggregation of the sub-indices that reflect financial stress in a specific market segment. The sub-indices are aggregated in the same way as individual risks are aggregated in order to quantify overall portfolio risk. As a result the indicator puts relatively more weight on situations in which stress prevails in several market segments at the same time.

The aggregation takes account of the time-varying cross-correlations between the sub-indices. To model cross-correlations we use a multivariate GARCH, which seems to be able to capture abrupt changes in the correlation and should make it possible for the indicator to identify systemic liquidity events precisely (Louzis and Vouldis, 2013).

The approach to validation of the indicator is based on the propositions of Illing and Liu (2006) and Louzis and Vouldis (2013). As in these papers, we conduct a survey among financial market experts inside and outside the Bank of Italy to determine the most liquidity stressful events for the Italian financial markets; we then evaluate the indicator on its ability to match the results of the survey.

The remainder of the paper is organized as follows. The next section contains a survey of the most recent literature on liquidity and systemic risk indicators. Section 3 presents the raw indicators we selected in order to capture the signs of liquidity stress in three representative Italian market segments. Section 4 explains the methodology for constructing the indicator while in Section 5 the empirical results are discussed. In Section 6, the indicator is evaluated in terms of its ability to identify well-known periods of liquidity stress and the robustness properties of the indicator are evaluated; Section 7 concludes.

2. The literature on liquidity and systemic risk indicators

Since the aftermath of the financial crisis, an extensive empirical and methodological literature has been developed in order to define stress indicators able to capture the systemic dimension of financial stress (i.e. the correlation between markets).[2]

Three main questions need to be addressed in defining and developing a financial systemic risk indicator: (1) how is systemic risk; (2) which variables should we consider, especially when we concentrate on liquidity risk; and (3) what is the most suitable methodology for aggregating variables?

Identifying systemic risk is not easy, as it is difficult to define and quantify, even if it is a term widely used (IMF, 2009). De Bandt and Hartmann (2000) highlight the presence of contagion effects at the heart of systemic risk, by stressing that systemic risk goes beyond the traditional view of individual banks' vulnerability to depositor runs. Accordingly, systemic risk can be defined as the systemic event that causes a particularly strong propagation of failures from one institution, market or system to another.

Recent research suggests a better approach to systemic financial risk as a continuous variable, with crisis as an extreme value, allowing more information to be contained in the stress measure and avoiding some arbitrary boundaries for the beginnings and ends of crises (Illing and Liu, 2003, 2006). With the aim of pursuing the supervisory objective of averting risk manifestations in the financial system, Illing and Liu (2003, 2006) develop systemic indices as financial stress indices. Exploring systemic risk in Canada from a supervisory perspective, Illing and Liu (2006) provide an overview of different observable variables used to assess crises originating in the banking, foreign exchange, debt and equity sectors, as well as multi-sector, composite crises. They show how stress measures vary between and within the crisis categories, sometimes referring to more subjective or objective criteria. Hanschel and Monin (2005) use the same methodology to investigate systemic risk in Switzerland.

The selection of variables is a critical process since it is fundamental to consider all the possible financial market variables able to capture key features of financial stress (Hakkio and Keeton, 2009; Illing and Liu, 2006; Hanschel and Monin, 2005). Depending on the availability of data and the aim of the analysis, the most recent studies tend to use alternatively market data (e.g. see Illing and Liu, 2006; Cardarelli et al., 2009; Hatzious et al., 2010), individual data, i.e. balance-sheet data (Morales and Estrada, 2010), or a combination of both (Hanschel and Monin, 2005). If we concentrate only on liquidity risk, as in our paper, we find that, with a few exemptions,[3] most studies have investigated the liquidity of individual financial assets or the behavior of banks (e.g. Van den End Jan and Tabbae, 2012), rather than the liquidity of individual markets. As Amihud (2002) argues, liquidity is an elusive concept as it is not observed directly and has a number of aspects that cannot be captured in a single measure. Market microstructure research consider market liquidity according to at least one

[2] See IMF (2009) and Bisias et al. (2012) for surveys.

[3] See Chordia et al. (2000), who study market liquidity, and Chordia et al. (2001), who analyze the correlation of liquidity measures between markets.