

Data description for *Modeling non-stationarities in high-frequency financial time series*

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In this supplemental text, we present a detailed description of the data we used.

I. DATA SET

A. General description

The data set includes high-frequency trades registered at Italian Stock Exchange (BIIt or Borsa Italiana), from the 03rd of February 2011 to the 09th of March 2011. The data of February 14th 2011 are not used because, on that day, there were technical problems at BIIt. Moreover, we have removed the data of the 21st of February, as well. In fact, on that day, there was a crash in the Italian market related to the events in Lybia (on the 15th of February, a rebellion against the Lybian government begun). We consider the 40 shares in the FTSE MIB index at the time, namely: A2A, STS, ATL, AGL, AZM, BP, BMP, PMI, BUL, BZU, CPR, DIA, ENE, EGP, ENI, EXO, F, FI, FNC, FSA, G, IPG, ISP, LTO, LUX, MS, MB, MED, PLT, PC, PRY, SPM, SRG, STM, TIT, TEN, TRN, TOD, UBI, UCG. Further information on the database and the full meaning of the symbols is available from www.borsaitaliana.it. Table I shows the meaning of the ticker symbols as well as the number of observations for each share. The forty stocks composing the FTSE MIB vary in their average market capitalization and exhibit different levels of trading activity with different numbers of trades over this period as summarized in the last column in Table I where the total number of observations in the chosen month is given. Choosing one month of high-frequency data was a trade-off between the necessity of using enough data for significant statistical analysis and, on the other hand, the goal of minimizing the effect of external economic fluctuations leading to non-stationarities of the kind discussed in [1]. For every stock, the data set consists of prices $p(t_i)$, volumes $v(t_i)$ and times of execution t_i , where i is the trade index, varying from 1 to the total number of daily trades N . These data were filtered in order to remove misprints in prices and times of execution. In particular, concerning prices, when there are multiple prices for the same time of execution, we consider only one transaction at that time and a price equal to the average of the multiple prices, and concerning the waiting times, τ , between two executions, we remove observations larger than 200 s: This means more than 3 minutes without recorded trading.

B. FTSE MIB Index

The FTSE MIB Index (see [2]) is the primary benchmark index for the Italian equity markets. Capturing approximately 80% of the domestic market capitalisation, the Index is made up of highly liquid, leading companies across Industry Classification Benchmark (ICB) sectors in Italy. The FTSE MIB Index measures the performance of 40 shares listed on Borsa Italiana and seeks to replicate the broad sector weights of the Italian stock market. The Index is derived from the universe of stocks trading on BIIt. The Index replaces the previous S&P/MIB Index, as a benchmark Index for Exchange Traded Funds (ETFs), and for tracking large capitalisation stocks in the Italian market. FTSE MIB Index is calculated on a real-time basis in EUR. The official opening and closing hours of the FTSE MIB Index series coincide with those of BIIt markets and are 09:01 and 17:31 respectively. The FTSE MIB Index is calculated and published on all days when BIIt is open for trading.

FTSE is responsible for the operation of the FTSE MIB Index. FTSE maintains records of the market capitalisation of all constituents and other shares and makes changes to the constituents and their weightings in accordance with the Ground Rules. FTSE carries out reviews and implement the resulting constituent changes as required by the Ground Rules. The FTSE MIB Index constituent shares are selected after analysis of the Italian equity universe, to ensure the Index best represents the Italian equity markets.

The FTSE MIB Index is calculated using a base-weighted aggregate methodology. This means the level of an Index reflects the total float-adjusted market value of all of the constituent stocks relative to a particular base period. The total market value of a company is determined by multiplying the price of its stock by the number of shares in issue (net of treasury shares) after float adjustment. An indexed number is used to represent the result of this calculation in order to make the value easier to work with and track over time. As mentioned above, the Index is computed in real time. The details on how to compute it can be found in [2].

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TABLE I. Symbols and number of observations for the 40 assets composing the FTSE MIB index in February-March 2011

Asset	Symbol	Number of observations
A2A	A2A	17987
Ansaldo STS	STS	14252
Atlantia	ATL	25811
Autogrill Spa	AGL	15834
Azimut	AZM	14779
Banco Popolare	BP	70373
Bca MPS	BMPS	38005
Bca Pop Milano	PMI	32132
Bulgari	BUL	20164
Buzzi Unicem	BZU	25236
Campari	CPR	14789
Diasorin	DIA	16386
Enel	ENEL	73223
Enel Green Power	EGPW	29305
ENI	ENI	77280
Exor	EXO	26108
Fiat	F	84641
Fiat Industrial	FI	52212
Finmeccanica	FNC	31566
Fondiaria-SAI	FSA	21169
Generali Ass	G	60561
Impregilo	IPG	16414
Intesa Sanpaolo	ISP	84525
Lottomatica	LTO	14313
Luxottica Group	LUX	25717
Mediaset	MS	32019
Mediobanca	MB	37848
Mediolanum	MED	17185
Parmalat	PLT	30861
Pirelli & C	PC	27023
Prysmian	PRY	32806
Saipem	SPM	57592
Snam Rete Gas	SRG	25324
STMicroelectronics	STM	54515
Telecom Italia	TIT	49576
Tenaris	TEN	36410
Terna	TRN	21836
Tod's	TOD	14811
Ubi Banca	UBI	31541
UniCredit	UCG	168433
Index	FTSE MIB	405560

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- [1] G. Livan, J. Inoue, and E. Scalas, J. Stat. Mech. , P07025 (2012).
[2] FTSEMIB, *Methodology for the management of the FTSE*

MIB index, Version 2.0 (Borsa Italiana, London Stock Exchange Group, London, U.K., 2011).