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Florian Ielpo and Dominique Guégan

Centre d'Economie de la Sorbonne

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Dominique Guégan

Florian Ielpo

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CES, UMR 8174, Paris 1 Panthéon Sorbonne, 12 place Panthéon Sorbonne, 75231 Paris Cedex 05
Ecole Normale Supérieure de Cachan, 61 avenue du Président Wilson, 94234, Cachan Cedex

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Dominique Guégan† and Florian Ielpo‡

Abstract

US interest rates' overnight reaction to macroeconomic announcements is of tremendous importance when trading fixed income securities. Most of the empirical studies achieved so far either assumed that the interest rates' reaction to announcements is linear or independent to the state of the economy. We investigate the shape of the term structure reaction of the swap rates to announcements using several linear and non-linear time series models. The empirical results yield several not-so-well-known stylized facts about the bond market. First, and although we used a daily dataset, we find that the introduction of non linear models leads to the finding of a significant number of macroeconomic figures that actually produce an effect over the yield curve. Most of the studies using daily datasets did not corroborate so far this conclusion. Second, we find that the term structure response to announcements can be much more complicated that what is generally found: we noticed at least four types of patterns in the term structure reaction of interest rates across maturities, including the hump-shaped one that is generally considered. Third, by comparing the shapes of the rates' term structure reaction to announcements with the first four factors obtained when performing a principal component analysis of the daily changes in the swap rates, we propose a first interpretation and classification of these different shapes. Fourth we find that the existence of some outliers in the one-day changes in interest rates usually leads to a strong underestimation of the reaction of interest rates to announcements, explaining the different results obtained between high-frequency and daily datasets: the first type of study seems to lead to the finding of fewer market mover announcements.

Keywords: Macroeconomic Announcements, Interest Rates Dynamic, Outliers, Reaction Function, Principal Component Analysis.

JEL Codes: G14, E43, E44

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†CES-AC, Ecole Normale Supérieure de Cachan, Avenue du Président Wilson, 94230 Cachan. guegan@ecogest.ens-cachan.fr

‡Corresponding author. Dexia Credit Local, 7/11 quai André Citroen, 75015 Paris and CES-AC, Ecole Normale Supérieure de Cachan, Avenue du Président Wilson, 94230 Cachan. Email: florian.ielpo@clf-dexia.com, Tel : 01 43 92 72 43.

1 Introduction

Much has already been said about the processing of unexpected information by bond prices: surprises in macroeconomic announcements are known to affect both the fair price perception of bonds - and thus their daily price changes - and their volatility. We propose here a new methodology to measure the market responses to macroeconomic surprises, using nested time series models. This way, we show that the market reaction to announcements may strongly differ depending on the monetary and economic cycle. First, when taking into account the business cycle and the existence of outliers within the dataset, many announcements produce effects on the yield curve. Second, we pointed out several shapes for the term structure reaction to announcements, surprisingly matching the shapes of the first four factors obtained when performing a principal component analysis over the daily changes in interest rates. Third, we show that these jumps in interest rates strongly depend upon outliers: by using threshold variables, we show that when the Fed's target rate or the PMI index is unusually high, market participants seem to have odd and extreme reactions that produce measurement error during the estimation over the whole sample. Finally, we point out the fact that when eliminating the outliers from the dataset, the hump-shaped reaction function across maturities is upper and more concave than what is usually found in similar studies.

The understanding and the measurement of the interest rates' response to unexpected surprises in macroeconomic announcements is of particular importance when building interest rates models. This partly explains the important development of the literature devoted to this subject. This litterature is now essential for the recent *macrofinance* literature (see e.g. Ang et al. (2005), Piazzesi and Swanson (2004) and Wu (2001)). Fleming and Remolona (1997) propose an extensive survey of the existing literature: most of it investigate the impact of a selected number of macroeconomic figures on selected points of the yield curve. For example, Grossman (1981) and Urich and Watchel (1981) chose to focus on money supply surprises for selected maturities of the yield curve. Hardouvelis (1988) and Edison (1996) investigated the impact of employment news along with Consumer Price Index (CPI) and Producer Price Index (PPI) in a similar fashion. While the former studies used daily datasets, the most recent ones made the most of the newly available high-frequency data, assuming that the measurement of the interest rates' reaction to surprises on a narrower window of time was bound to lead to more precise results. The results obtained pointed toward important facts: where studies achieved using daily data only found a few market mover figures, these studies (see for instance Balduzzi et al. (2001), Fleming and Remolona (1997) and Fleming and Remolona (2001)) concluded with the fact that as much as 70 releases actually produce moves within the U.S. bond markets.

Finally, recent papers showed that there exist a *whole term structure response to macroeconomic news*. Using an intraday dataset, Fleming and Remolona (2001) showed that these term structure effects look like humps. A immediate question is then : is each hump alike? This type of question is of particular importance when trying to identify the factors that actually move the bond market: does one need a one factor model, as proposed in Vasicek (1977) or Cox et al. (1985), or a multiple factor model as proposed in Chen and Scott (1993)? For a multi-factor term structure model to be consistent with the data, the answer should naturally be negative. And what about the true shape of these factors? Most of the literature assume them to be mean reverting in some sort, but little is known on their true properties. This paper is devoted to the gathering of empirical results so as to tackle these issues.

In this paper, we propose different nested time series models to assess the shape of the term structure reaction to macroeconomic announcements. First, we find that there exist several types of surprises that actually affect the bond market, surprisingly matching the first four factors found when performing a principal component analysis over the daily changes in swap rates. We propose some possible interpretations of these factors on the basis of the existing literature. Second, we underline some evidence that the market mover figures that are of interest strongly depend upon the market perception of the economic cycle, measured by publicly available indicators, and upon the monetary policy stance, measured by the Fed's target rate. Finally, we show that the use of a threshold model when estimating the market response to macroeconomic news leads to the elimination of outliers within the dataset, yielding different - and often more significative - estimates of the market response to selected figures. The exclusion of these outliers brings about interest rates' reaction functions

that are generally upper than the classical ones and more concave.

The paper is organized as follows: in, Section 2, we present the methodology to estimate the term structure response to macroeconomic news. Section 3 is dedicated to the presentation of the in-depth analysis of the empirical results we found. Section 4 concludes.

2 Methodology

In this Section, we detail both the dataset and the time series models used to analyse the effect of the announcements on the US swap rate across maturities. The dataset used along the paper and its preliminary treatment is closed to the one used in the main articles investigating the bond market reaction to macroeconomic news, such as Balduzzi et al. (2001) and Fleming and Remolona (2001). The main novelty of this paper being the methodology, we present it in a detailed fashion so as to highlight our contributions.

2.1 The dataset

Along this paper we use two types of data. On the one hand, we use the daily changes in the US swap rates from June, 24^{th} of 1996 until March, 1^{st} 2006, for the following maturities: 1- to 10-year, 15-year, 20-year and 30-year swap rates. By daily changes, we mean the difference between two following daily closing rates. Let $\Delta r_t(\tau)$ be this change in the closing swap rate $r_t(\tau)$ for a maturity equal to τ, on a date t. Then, we have:

$$\Delta r_t(\tau) = r_t(\tau) - r_{t-1}(\tau), \tag{1}$$

with a time unit equal to one day. One main advantage to use swap rates is that they are generic rates: these rates have a constant time to maturity over the whole sample and thus do not theoretically depend on time. Using such rates means that we do not have to deal with the reduction of the time to maturity. We also had to estimate some missing rates, which was done using the cubic splines method, like in Bomfim (2003)[1].

The US swap rates dataset has been extracted from the Bloomberg database. The Bloomberg closing swap rates are gathered from different brokers and financial institutions at the closing of each US bond market trading day. During a trading day, the moments the intraday database is updated is rather random and this randomness extents to the maturities that are updated. On the contrary, for the closing swap rates, the time of the update is rather homogeneous. This is why we propose to use a daily dataset made of these closing swap rates.

From the Bloomberg database, we also extracted the US economic calendar across the dates already mentioned for the swap rates. This calendar contains every economic announcement linked to the US economy which are supposed to be monitored by financial market participants. Several of these figures are well known by economists, such as the Non Farm Payroll figure, which is the number of jobs created on a one month period. These figures are issued regularly by office statistics such as the Bureau of Labour Statistics. For example, the Non Farm Payroll figure is issued every first Friday of a month and is usually followed by large moves in the bond market. Other figures are no so well known, and one of the purposes of this paper is to cast some light on the effect of these indicators on the term structure of the US swap rates.

We discarded several series from the Bloomberg database. Table 2.1 presents the selected figures used during the estimation process. We eliminated these series for different reasons. First, some of the figures got their names changed over the studied period. In this case, we simply changed the old names into the newer ones so as to avoid having a single figure known under different names. This was the case for the Michigan Consumer Confidence that was reported under several names in the Bloomberg Calendar. Second, some of these figures

[1] This is a classic method, discussed in classical textbooks, e.g. Martellini et al. (2003).

Growth	Conjonctural Indicators	Real estate
Industrial New orders	ISM manuf	Construction Spending
Wholesale Inventory	Philifed Index	Housing Start
Industrial Production	Conf. Board Consumer Conf.	Existing Home Sales
GDP	Chicago PMI	New Home Sales
Trade Balance	Non Manuf. ISM	Building Permits
Capacity Utilization Rate	Consumer Conf. Michigan	NAHB Housing Market Index
Durable Good Orders	Empire Manufacturing	Construction Spending
Labor Market	**Consumption**	**Inflation**
Unemployment Rate	Household Consumption	Consumer Price Index
Jobless Claims	Personal Income	Producer Price Index
Non Farm Payroll	Consumer Credit	Import Price Index
Employment Cost Index	Retail Sales	
Wages	Personal Consumption (Q)	
Hourly Average Wages		
Weekly Working Hours		
Weekly Jobless Claims		
Indice Help Wanted		

Table 1: List of the macroeconomic announcements studied in this paper. These announcements are monthly ones, except for: Weekly Jobless Claims (weekly figure), Personal Consumption (quarterly figure), Capacity Utilization Rate (quarterly figure) and GDP (quarterly figure).

were ill reported and included a lot of missing values. Finally, some of these figures ceased to be released during the studied period, such as the M3 aggregate and we chose not to include them, to make this study of interest both for academics and practitioners.

Most of the announcements studied are monthly (see Table 2.1). The series were treated by the Bloomberg calendar the way bond market participants do. For example, the surprise in the Consumer Price Index (CPI hereafter) is a surprise in the month-over-month figure. A month-over-month (m-o-m hereafter) figure is simply the percentage of growth of the index over the month. With an index denoted I_t for the month t, the m-o-m figure will be equal to $\frac{I_t}{I_{t-1}} - 1$, with a time unit equal to one month. The same kind of transformation applies for most of the figures but the sentiment survey such as Purchasing Manager Index (PMI) or Michigan Consumer Confidence. These survey figures are often presented using the value of their index. This is a rather technical knowledge many books are devoted to. Anyone interested in these ways of processing data can get in depth analysis in such books (see e.g. Baumohl (2005)).

In our methodology, we used the first estimates of the macroeconomic news. Most of the macroeconomic figures released in the US are initially preliminary estimates. On the next announcement for the same figure, a revised estimate of the preceding figure is released. Most of the macroeconomic datasets used in empirical papers are made of the revised estimates of every macroeconomic figures. Recently, Orphanides (2001), Bernanke and Boivin (2001) and Kishor and Koenig (2005), among others, took this data revision problem into account, highlighting the importance of this phenomenon on macroeconomic empirical models. For our purposes, the use of the first estimate is of tremendous importance: the first announcement is the one bond market participants had to face with and eventually reacted to.

What is more, the Bloomberg calendar also contains the Bloomberg forecasts regarding each of these figures. Bloomberg forecasts are formed using the 50% empirical quantile of the distribution of a survey made of the forecasts of several bank economists, regarding a precise figure. The use of the median as a measure of the expectations makes the forecast robust to the influence of badly intentionned economists that would want to shift the forecast in order to make the most of it. What is more, this forecast is extensively used by market participants. For each figure that is predicted by Bloomberg's collection of economists' forecasts, the median is regularly updated until every economist answers the survey, which can take up to two weeks. We retained the last median computed by the Bloomberg services, so as to match both the practioners and academic ways of doing things. Some of the eliminated series were discarded because there was no available forecast.

2.2 Assessing the shape of the market reaction function

In this section, we skip to the presentation of the time series models used along the paper. The first model is the classical linear model. Let $S_{t,i}$ denote the surprise at time t in the figures indexed by i as follows:

$$S_{t,i} = \frac{R_{t,i} - F_{t,i}}{\sigma_{S_i}}, \tag{2}$$

where $F_{t,i}$ is the market consensus about the upcoming figures i for t, the date of release; $R_{t,i}$ is the real announcement (the first estimate) at time t of the same figure i. To make the surprises comparable, surprises are scaled using their historical standard deviation. This way of proceeding is very common, see e.g. Edison (1996), Fleming and Remolona (1997, 2001) and Balduzzi et al. (2001).We used the Bloomberg forecasts as a measure of the market consensus for a given figure at a given date. Thus, F_t^i will be proxyed by the last forecast in the Bloomberg database for each announcement.

Building a time series model to relate the macroeconomic surprises to the changes in the interest rates of maturity τ requires some preliminary considerations, and especially for the dataset building. Even though there seems to be some regularity in the time of arrival of these surprises, they are irregularly spaced in time, preventing the building of a single global model to relate any surprises to the daily changes in rates. For example, the Non Farm Payroll are scheduled to be released on the first Friday of each month: even though this seems to be a regular release pace, it still leads to data that are irregularly spaced in time, in so far as the number of days from the first Friday of a month to the next one is not always the same. What is more, estimating a global model as asserted before would involve the use of 40 exogenous variables which may threaten the robustness of the results. Moreover, the sampling frequency of the exogenous variables can differ: our work involves both quarterly, monthly and weekly news. Finally, the endogenous variable (namely $r_t(\tau)$) depends on the maturity τ of the swap rates. For several maturities, the model to built should be a generalized linear model (a model that encompasses several dependent variables in the meantime), which thus requires to be estimated using the (Quasi) Generalized Least Squares. To solve these difficulties, we built one model for each each surprise and each maturity, in a similar fashion to the *Seemingly Unrelated Regression Models*. This has an obvious consequence over the chosen notations: the subscripts must display the dependency on time, maturity and macroeconomic surprise.

Now, let us denote $\Delta r_{t,i}(\tau)$ the daily change in swap rate of maturity τ on the date t of the release of the figure indexes by $i = \{1, ..., I\}$, where I is the total number of surprises. The couple (t, i) is somewhat a calendar coordinate in the global dataset. The linear model (model 1 hereafter) assumes for given (fixed) $i = \{1, ..., I\}$ and $\tau = \{\tau_1, ...\tau_m\}$ that:

$$\Delta r_{t,i}(\tau) = \beta_{i,\tau} + \alpha_{i,\tau} S_{t,i} + \epsilon_{t,i,\tau}, \tag{3}$$

where $\alpha_{i,\tau}$ and $\beta_{i,\tau}$ are real-valued parameters. $(\epsilon_{t,i,\tau})_t$ is a Gaussian white noise with standard deviation $\sigma_{i,\tau}$, conditionally upon $S_{t,i}$. In the remaining of the paper, we denote these conditions as conditions 2.2. This very simple model is usually augmented with the other surprises announced on the same day (t, i):

$$\Delta r_{t,i}(\tau) = \beta_{i,\tau} + \alpha_{i,\tau} S_{t,i} + \sum_{j=1}^{J} \gamma_{j,\tau} S_{t,i}^j + \epsilon_{t,i,\tau}, \tag{4}$$

where $S_{t,i}^j$ are the scaled surprises j announced on the same day as surprise i. Again, we assume that $\gamma_{j,\tau}, \forall j$ is on the real line. These additional surprises are essential to ensure that the estimated $\alpha_{i,\tau}$ truly isolate the effect of the announcement that is analyzed.

In this section, we build a collection of nested time series models to capture the term structure reaction to macroeconomic news. The linear model defined by equation (3) is the first model. For the ease of the presentation, we will get rid of the part of the equation (4) that is dedicated to the announcements released on the same date as the announcement studied (that is $\sum_{j=1}^{J} \gamma_{j,\tau} S_{t,i}^j$), maintaining it during the estimation. What

is more, for the sake of simplicity, we do not denote anymore the maturity of each change in the swap rate, skipping from $\Delta r_{t,i}(\tau)$ to $\Delta r_{t,i}$ (the same treatment also applies to the parameters of the model): we present the models for a given and fixed τ.

The immediate consequence of the model 1-like specification is:

$$\mathbb{E}[\Delta r_{t,i}|S_{t,i}] = \beta_i + \alpha_i S_{t,i}. \tag{5}$$

This expectation has an important implication: whatever past information and the state of the economy, the conditional expectation of the rates' jump is always the same, for a given surprise, i.e. $\alpha_i S_{t,i}$. This is not in line with what can be observed both by practitioners and academics. We propose two nested non-linear models to account for these facts.

First, with model 1, the market reaction to a given surprise is bound to be the same for each state of the economy. The rates'response to macroeconomic announcements may depend on several factors such as the timeliness of the release - that is the order of release for a one month period -, the degree of surprise, the conditions of market uncertainty or the sign of the surprise. On these points, see Fleming and Remolona (1997) and Hans (2001). Other articles pointed toward the fact that the interest rates'response to macroeconomic announcements may also depend on a threshold variable, such as economic leading indicators or employment figures. For example, Prag (1994) shows that the impact of unemployment surprises on the bond prices may depend on the current level of unemployment. Veredas (2005) shows that the market response to surprises in macroeconomic releases strongly depends upon the momentum of the cycle: in this framework, bad news have more impact on bond prices during expansion periods than recession ones. Here, we argue that the market response depends on several threshold variables, including indicators for monetary policy stance and economic agent sentiment regarding future activity.

Thus, we propose to use a threshold time series model. Given the small number of observations we have at hand[2], we will consider a two states economy, say recession/expansion states. Let us define $(\pi_{t,i})_{t\in\mathbb{Z}}$, an observable process that is used as a state variable to capture the conditional reaction to the surprises in the macroeconomic figure i. With this state variable, we measure the state of the economy as follow: this process has to cross a threshold value $\bar{\pi}_i$ for for the economy to go through a change in state, say from expansion to recession. For each $i \in \{1, ..., I\}$, model 2 is then the following:

$$\Delta r_{t,i} = \beta_i + \alpha_{1,i}\mathbb{1}_{\pi_{t,i}>\bar{\pi}_i} S_{t,i} + \alpha_{2,i}\mathbb{1}_{\pi_{t,i}\leq\bar{\pi}_i} S_{t,i} + \epsilon_{t,i}, \tag{6}$$

where $\mathbb{1}_{\pi_{t,i}>\bar{\pi}_i}$ takes value 1 if $\pi_{t,i} > \bar{\pi}_i$ and 0 if not. $\mathbb{1}_{\pi_{t,i}\leq\bar{\pi}_i}$ is defined as $1 - \mathbb{1}_{\pi_{t,i}>\bar{\pi}_i}$. $\alpha_{1,i}$ and $\alpha_{2,i}$ are again on the real line. The assumption 2.2 applies again. This model belongs to the class of the SETAR models (Self-Exciting Autoregressive models) introduced by Lim and Tong (1980) and developed in Tong (1990).

The estimation of threshold models has been discussed in Chan (1990), Hansen (1997, 2000) and Tong (1990) [chapter 5], and asymptotic estimation results have been derived in it. With these models, the log-likelihood function is not continuous in the threshold parameter. Thus, the threshold cannot be estimated using standard Gradient methods. The estimation can be performed by grid search. This is a standard method in econometrics, as detailed in Greene (2000), in the chapter dedicated to numerical optimization.

The model proposed in equation (6) leads to the following conditional expectations:

$$\mathbb{E}[\Delta r_{t,i}|\pi_{t,i} > \bar{\pi}_i, S_{t,i}] = \beta_i + \alpha_{1,i} S_{t,i} \tag{7}$$

$$\mathbb{E}[\Delta r_{t,i}|\pi_{t,i} \leq \bar{\pi}_i, S_{t,i}] = \beta_i + \alpha_{2,i} S_{t,i}. \tag{8}$$

Thus, the market reaction clearly differs, depending upon the state variable. Once again, each macroeconomic figure can be linked to a proper threshold variable $(\pi_{t,i})_{t\in\mathbb{Z}}$, along with a proper threshold value $\bar{\pi}_i$. Now,

[2]For monthly figures, we only have one announcement a month, which makes 120 observations with no missing value in the dataset. For the quarterly figures, this makes only 30 observations.

we need to select variables to proxy this state variable. Clearly, there is no unique answer: sentiment survey (such as PMI index or Conference Board index) could be a good proxy for this variable. These sentiment survey can be considered as coincident or leading indicators of the stance of the economy and thus reflects the market sentiment better than real aggregates such as industrial indicators or GDP. Monetary policy is also known to play an important part in the psychology of the bond market. This is why we also introduced the Fed's target rate, as a measure of the monetary policy stance.

The table 2 presents the different threshold variables that we retained for the estimation of the threshold model. Note that to these variables, we add the first and second factors of a principal component analysis performed over all these variables, so as to get a global economic confidence index. This is a classical method used to build this kind of global economic stance index (see e.g. Stock and Watson (1998)). So as to avoid any data vintage problem, as presented e.g. in Kishor and Koenig (2005), we used the first estimates of every of these series: they were the ones at hand for market participants, at the time of their reactions to the announcements. In the section dedicated to the estimation results, we present the results of the choice of the threshold variable. For each surprise, we retain the threshold value that yielded the highest log-likelihood value or the lowest root mean square error. These results show the benefit from estimating each model for each macroeconomic figure and each maturities: the selected threshold variable can clearly differ depending both on the rates' maturity and the figure that is studied.

Indicator...	**... as a measure of**	**Mean**	**Std. Deviation**
PMI	Future economic activity	53,02	5,26
Conf. Board	Future economic activity	112,24	21,00
Michigan	Future economic activity	96,80	8,90
Fed Target Rate	Monetary policy stance	3,73	1,91
Fed Philadelphie	Future economic activity	9,54	13,52
Factor 1	-	87,30	14,30
Factor 2	-	-128,47	18,38

Table 2: Threshold variables used in the estimation process

In the table presenting the results of our estimations, we refer to these threshold variables using the following notations: PMI is for PMI index, CONF is for Conference Board Consumer Confidence, MICH is for Consumer Confidence Michigan, FED is for the Fed Target Rate, PHI is for the Philifed Index and FACT1 and FACT2 refer to the first two factors of a principal component analysis performed over all these series.

Finally, we propose to test for path dependency in the dynamics of the rates. By this, we simply mean to specify a model that would link the rates' reaction during two successive announcements of the same figure. Note that most of the time, a month elapsed between two successive announcements. We propose to test whether a part of $\Delta r_{t_k,i}$ is explained by the rates' reaction at time (t_{k-1}, i), that is the bonds over- or under-reaction during the former announcement for exactly the same figure i. When model 2 provides consistent estimates of the reaction reaction of the market to announcements, the residuals of this model can be used as a proxy to measure the rates' over or under reaction to a given announcement. Thus, a natural measure of the market absolute overreaction at time (t_{k-1}, i) is $\epsilon_{t_{k-1},i}$. By adding this term to the model proposed in equation (6), we obtain model 3:

$$\Delta r_{t_k,i} = \beta_i + \alpha_{1,i}\mathbb{1}_{\pi_{t_k,i}>\bar{\pi}_i} S_{t_k,i} + \alpha_{2,i}\mathbb{1}_{\pi_{t_k,i}\leq\bar{\pi}_i} S_{t_k,i} + \theta\epsilon_{t_{k-1},i} + \epsilon_{t_k,i}, \tag{9}$$

where $\theta_i \in \mathbb{R}$ such that $\mathbb{E}[\Delta r_{t_k,i}] < \infty$. Conditions 2.2 still apply. By the law of iterated expectations, $\mathbb{E}[\epsilon_{t_k,i}] = \mathbb{E}[\mathbb{E}[\epsilon_{t_k,i}|\pi_{t_k,i}, S_{t_k,i}, \epsilon_{t_{k-1},i}]] = 0$. Thus, we can rewrite equation (9) with a mean reverting error process:

$$\Delta r_{t_k,i} = \beta_i + \alpha_{1,i}\mathbb{1}_{\pi_{t_k,i}>\bar{\pi}_i} S_{t_k,i} + \alpha_{2,i}\mathbb{1}_{\pi_{t_k,i}\leq\bar{\pi}_i} S_{t_k,i} - \theta_i(\mathbb{E}[\epsilon_{t_{k-1},i}] - \epsilon_{t_{k-1},i}) + \epsilon_{t_k,i}. \tag{10}$$

The interpretation of θ_i in equation (10) arises naturally. Let us distinguish three cases. If $\theta_i = 0$, this obviously means that there is no linear link between the past overreaction and the current one. Second, if $\theta_i > 0$,

the bond market tends to be self exciting: when an over/undershoot occurs when releasing a figure, then there is a higher probability that the market will over/undershoot again on the next release of the same figure. On the contrary, if $\theta_i < 0$, the market responses to announcements are mean reverting (toward a mean equal to 0). In the latter case, an over/undershoot is likely to be followed by a smoother reaction on the date of the next release of the same figure. Note that from a statistical point of view, if θ_i is significatively different from 0, the estimation of model 1 is likely to be biased.

The conditional expectation of $\Delta r_{t_k,i}$ is path dependent: the rates' response will depend on their former reaction to the announcement of the same figures. Thus we have:

$$\mathbb{E}[\Delta r_{t_k,i}|\pi_{t_k,i} > \bar{\pi}_i, S_{t_k,i}, \epsilon_{t_{k-1},i}] = \beta_i + \alpha_{1,i} S_{t_k,i} + \theta_i \epsilon_{t_{k-1},i} \tag{11}$$

$$\mathbb{E}[\Delta r_{t_k,i}|\pi_{t_k,i} \leq \bar{\pi}_i, S_{t_k,i}, \epsilon_{t_{k-1},i}] = \beta_i + \alpha_{2,i} S_{t,i} + \theta_i \epsilon_{t_{k-1},i}. \tag{12}$$

From this point, we now obtain a collection of nested models that will help us document further the admissible shapes of the bond market reaction function to macroeconomic announcements. This rather simple approach thus entitles us to build *LR* tests, as described in Davidson and MacKinnon (1993). Models 1, 2 and 3 are nested, and likelihood ratio tests can be easily performed so as to chose which is the more interesting model, regarding the data at hand. These elements will be studied within the next section, along with the analysis of the results obtained with the models defined by equations (3), (6) and (9). In the remaining of the paper we refer to the model defined by equation (3) as model 1, to the one defined by equation (6) as model 2 and to the model defined by equation (9) as model 3. These notations are summarized in the following table :

Model	**Equation #**	**Rates dynamic**
Model 1	Equation (3)	$\Delta r_{t,i} = \beta_i + \alpha_i S_{t,i} + \epsilon_{t,i}$
Model 2	Equation (6)	$\Delta r_{t,i} = \beta_i + \alpha_{1,i} \mathbb{1}_{\pi_{t,i} > \bar{\pi}_i} S_{t,i} + \alpha_{2,i} \mathbb{1}_{\pi_{t,i} \leq \bar{\pi}_i} S_{t,i} + \epsilon_{t,i}$
Model 3	Equation (9)	$\Delta r_{t_k,i} = \beta_i + \alpha_{1,i} \mathbb{1}_{\pi_{t_k,i} > \bar{\pi}_i} S_{t_k,i} + \alpha_{2,i} \mathbb{1}_{\pi_{t_k,i} \leq \bar{\pi}_i} S_{t_k,i} + \theta_i \epsilon_{t_{k-1},i} + \epsilon_{t_k,i}$

3 Empirical results

In this Section, we systematically analyse the results of the estimations of the models presented in the previous section. First, we analyse the results obtained from the likelihood ratio tests performed over the different nested models, using the dataset presented earlier. From these estimation results, we propose a list of the most market mover figures for each maturity and we show that by using model 2 the list of market mover figures significatively increases. We also notices that model 2 leads to intercepts that are statistically equal to 0, unlike model 1. Third, we propose to identify the shapes of the term structure response with those of the first four factors of a principal component analysis performed over the daily changes in the swap rates. By doing so, we show that there are several kinds of possible shapes for the hump-shaped term structure response to macroeconomic news (see e.g. Fleming and Remolona (2001)). Fourth, we propose a detailed analysis of the term structure response to several announcements, underlying the fact that the inclusion of a threshold variable reveals that model 1 often underestimates the true reaction function. We guess that this can either be due to the economic cycle dependence of the term structure effect or the existence of outliers within the dataset.

3.1 Bulk effects of the introduction of the threshold variable

The introduction of those threshold variables produced remarkable effects on our estimations, yielding results that we believe are new. We present in tables 6, 7 and 8 the results of the estimation obtained from the models presented in the previous section. We only present the estimates of the model with the higher log-likelihood function, along with the following LR test. For example, let model 1 be the constrained model, with log likelihood denoted lnL_c and model 2 be the unconstrained model, with a log-likelihood denoted lnL_u. The null hypothesis $\mathbb{H}_0$ assumes that the constraint imposed in model 1 statistically holds. Thus, under $\mathbb{H}_0$, model

1 is considered as a better model than the unconstrained model. Tables 6, 7 and 8 report the selected threshold variables along with the threshold value, that are estimated for each maturity and macroeconomic figures. We also report the LR test results, testing constrained against the unconstrained models. The test statistics is:

$$LR = 2(lnL_c - lnL_u), \tag{13}$$

with the previous notations. Under the null hypothesis that the constraint statistically holds, this statistic has a Chi-square distribution, with a degree of freedom equal to the number of constraints imposed in the constraint model. In our case, we have only one constraint, and the statistics is distributed as a χ^2_1, under the null. We proceed in a similar fashion to test model 3 vs. model 2.

The main result obtained with our methodology is that model 2 is globally the preferred model, regardless of the surprise and the maturity. When testing model 2 vs. model 1, the null is rejected at either a 5% or 10% risk level most of the time for every maturity. The few cases when it is not rejected are reported in table 3. This is an essential result for our work: model 2 provides a better explanation of the rates' behavior than model 1. Even though model 1 is the one that is generally proposed in the litterature, model 2 better encompases an important feature of the rates' dynamic: the economic cycle dependence. Note that we do not report the LR test of model 3 against model 2, because the model 3 was almost always rejected at either a 5% or 10% level when compared to model 2.

Economic Announcement	**Swap rates maturities**
Household Consumption	1,6,7,9 and 10 year
Employment Cost Index	15,20 and 30 year
Empire Manufacturing Index	4,5,6,7,8,9,10,15,20 and 30 year
Personal Consumption	2,3,4,5 and 6 year

Table 3: Announcements and maturities for which the null of the LR test is accepted, when testing model 2 vs. model 1.

The introduction of the state variables allowed us to point out more than the usual number of *" market movers"* figures: we consider that a market mover figure is an announcement for which the estimated impact in models 1 and 3 is significative up to a 5% percent test. Here, almost every announcement that we tested was found to have a significative influence on the yield curve. Fleming and Remolona (2001) assumed that the use of daily data instead of intra day ones were to bring about an underestimation of the market reaction function. Here, we find that considering the market responses conditionally upon a threshold variable that has been properly selected puts an end to this underestimation. Almost every announcement produces an effect on the yield curve. In appendices, we propose two comparative tables to assess this point. In table 9, we present the ranked market mover announcements found when estimating model 1. In tables 10 and 11, we report the ranked market mover announcements obtained when estimating model 2, along with the selected threshold variable and the threshold value. The main point about this table is that the number of market mover figures significantly increases when using model 2: the introduction of the threshold variable leads to the finding of a greater number of market mover figures. The exclusion of this threshold variable seems to bring about an underestimation of the term structure reaction to several announcements. In subsection 3.4, we detail some of the reasons explaining this new stylized fact.

One other remarkable fact about our methodology is the following: when estimating model 1, most of the intercepts are significative up to a 5% risk level, unlike when estimating model 2. Table 4 reports figures and maturities for which this intercept remains significative in model 2. Where the bond market to be efficient, there should be no significative intercept in the estimation of the proposed models. One may think of this constant term as an α in the Capital Asset Pricing Model framework[3], as presented in Gourieroux and Jasiak (2001) and Campbell et al. (1997). Tables 12 and 13 propose the results of the intercept estimation for models 1 and 3. Thus, when compared to model 2, model 1 is misspecified and leads to misleading ideas such as the

[3]The CAPM were initially developed by Sharpe (1964), Lintner (1965) and Mossin (1966).

idea that the bond market is not efficient[4].

Economic Announcement	Swap rates maturities
Household Consumption	3,4,6,7,8,9,10,15,30
Personal Income	2,3,4,6,7,8,9,10,15,30
ISM Manuf.	4,6,7,8,9,10,15,20,30
Existing Home Sales	8,9,15,20,30
Weekly Jobless Claims	1
Building Permits	1
Empire Manufacturing	1
Personal Consumption	1
Indice Help Wanted	1
NAHB Housing Index	1
Construction Spending	1,7,8,9,10,15,20,30

Table 4: Announcements for which the intercept is significative both for model (1) and model (3)

3.2 Term structure identification

We propose to move a step further toward the analysis of our results. When reading tables 6, 7 and 8, one can clearly see that most of the shapes of the term structure responses to macroeconomic news are *hump-shaped*, as already noted by Fleming and Remolona (2001). But even though most of them present this kind of shape, while analysing the results, we found different forms of these term structure responses. What is more, these shapes surprisingly match those of the correlation between swap rates across maturities and the first four factors of a principal component analysis (PCA hereafter) performed over the daily changes in the swap rates. Since Litterman and Scheinkman (1991), using PCA to assess the shape of the factors that are actually moving the yield curve is very classic. The method is still used for the analysis of bond market factors (see e.g. Lardic and Priaulet (2003)). On this preliminary remark, we propose a methodology to build a classification of the term structure responses of the swap rates to macroeconomic announcement using these four factors.

Using the dataset presented in Section 2, we performed a principal component analysis over the daily changes in the swap rates, with maturities ranging from 1- to 30-year. Figure 1 presents the correlations between the first four factors of the PCA and the one-day changes in the swap rate across maturities. Let us denote $F_{t,k}$ the value of the k^{th} factor on date t and $\Delta r_t(\tau)$ the change in the swap rate of maturity τ on the same date. For the time being, these notations are independent of the surprises. Then, let us denote $\rho_{k,\tau}$ the correlation:

$$\rho_{k,\tau} = cor\left(F_k, \Delta r_t(\tau)\right) \tag{14}$$

where $cor(.)$ is the correlation coefficient. We decided to consider[5] factors 1 to 4, using the classical elbow method to select the number of eigenvalues and eigenvectors to retain for this PCA. By studying the $\rho_{k,\tau}$, we are able to discuss the impact of the factor k on the yield curve. Figure 1 presents the correlations between each factor and the jumps in swap rates for a given maturity. Clearly, these factors do not seem to have the same impact on the yield curve. Factor 1 is considered as a level factor and is often related to the monetary policy stance (see e.g. Bomfim (2003), Wu (2001) and Ang et al. (2005)). Factor 2 is extremely well positively correlated (close to one) with the changes in one-year swap rates and thus governs the slope of the beginning of the yield curve. Factor 3 is highly correlated to the swap rates of maturities 2 to 7 years and thus drives the concavity of the curve. Finally, the fourth factor is well correlated to maturities a bit longer

[4] In a linear model with centered exogenous variables, the intercept can be interpreted as an average of the endogenous variable. In our case, this means that we are looking for regular effects over a given announcement. This effect is not the result of either a positive or a negative surprise, but simply the result of the fact that on this trading day, the announcement produces by itself a regular reaction in the bond market. Note that swap rates are used for many financial applications, such as deriving zero-coupon yield curve, pricing swaps or pricing interest rates derivatives such as swaptions. This kind of regular moves in the whole bond market can have significant implications for the whole bond market.

[5] Most of the studies achieved so far concluded with the fact that three factors were actually driving the pure discount bond yield curve. To our mind, one key explanation for this divergence with the classical literature is due the fact we use a very recent dataset.

than factor 3, that is maturities from 6 till 9 years, and is thus again a concavity factor. These results can also be found in other articles such as Steeley (1990), Litterman and Scheinkman (1991), Knez et al. (1994) and more recently Molgedey and Galic (2000) and Blaskowitz et al. (2005).

In this respect, our analysis identifies four types of factors: a first type that seems to be *hump-shaped* and should be theoretically driven by the conduct of monetary policy; a second type affecting mainly the short rate positively; a third type affecting negatively maturities for 2 to 7 years and a fourth one affecting negatively maturities from 6 to 9 years.

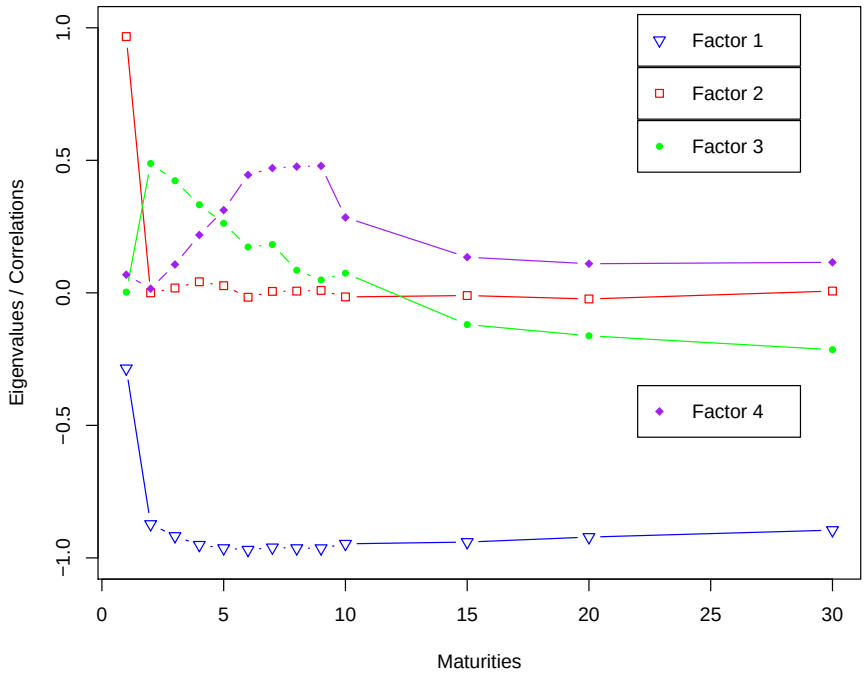

Figure 1: Correlations between factors 1 to 4 and the jumps in rates for maturities till 30 years

Noting that the shapes of the impact of the surprises on the yield curve are graphically close to the shapes of the correlations $\rho_{k,\tau}$ across maturities, we propose an identification process to be able to match the effect of the announcements to the factors of the PCA. We propose the following method. Let $\alpha_{i,\tau}$ be the estimate of the impact of the announcement i on the change in swap rate for a maturity τ. Thus, we have:

$$\Delta r_{t,i}(\tau_h) = \beta_{i,\tau} + \alpha_{i,\tau} S_{t,i} + \epsilon_{t,i,\tau}, \tag{15}$$

under the assumptions 2.2. Now, for a given announcement i, we propose to compare $\rho_{k,\tau}$ and $\alpha_{i,\tau}$ across maturities , for each factor k. Note that the $\alpha_{i,\tau}$ can either be estimated with model 1, 2 or 3: we present the methodology using model 1 as an example for the sake of notational simplicity. From now on, we propose to state that an announcement i produces a factor k-like effect on the yield curve when the distance between $\rho_{k,\tau}$ and $\alpha_{i,\tau}$ is the lowest across maturities τ and among the different possible factors. For this purpose, we propose to estimate the following linear model for each factor k and for a given announcement i:

$$\alpha_{i,\tau} = \gamma_0 + \gamma_1 \rho_{k,\tau} + \nu_{k,\tau}, \forall \tau, \tag{16}$$

and retain the estimated variance of $\nu_{k,\tau}$ as a distance measure between $\alpha_{i,\tau}$ and $\rho_{k,\tau}$. In equation (16), γ_0 and γ_1 are real-valued parameters estimated by OLS. ν_k a Gaussian white noise, with variance σ_k^2. Now, for example, if $\sigma 1^2$ is inferior to σ_2^2, σ_3^2 and σ_4^2 for a given surprise i, then we say that this surprise produce a factor 1-like effect on the yield curve.

In table 14, we report the results of the latter method, using the estimation results obtained with model 2. Table 5 provides empirical frequencies regarding the number of announcements per yield curve factor. Most of the announcements seem to match the factor 1 of the yield curve, but we found many other announcements matching the remaining factors. We believe that the results presented here are new, along with the idea that there are several types of shapes for the term structure announcements.

	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
Number	29	11	6	5
Total number	54	54	54	54
Empirical Frequency	0,54	0,20	0,11	0,09

Table 5: Number of announcements matching one of the factors of the yield curve found during the estimation process.

Now, an in depth analysis of the estimation tables yield two different findings: first, each announcement can have a different term effect on the term structure of the interest rates. While reading the estimation tables, what can be clearly noted is that most of the figures lead to a *hump-shaped* reaction function (a factor 1-like effect). Once the PCA is performed, this result should not surprise anyone: the first factor, that is the hump shaped one, is supposed to explain more than eighty percent of the total variance of the overnight change in swap rates sample at hand. Nevertheless, this kind of shape is not the only one that the results pointed out: we found three other shapes that clearly match that of the three remaining factors extracted using PCA. One supporting fact of our findings is that the empirical frequencies associated to this classification are quickly decaying, just like when analysing the eigenvalues obtained when performing a PCA over the rates. We believe that this fact is new. Second, we found that when modifying the threshold variable and the threshold value, a similar announcement can have different effects on the yield curve, depending upon the state of the US economy for example. A careful reading of table 14 should provide important results both to academics and practioners. We will document this point in the next subsection with well chosen examples.

3.3 Selected announcements and the underestimation problem

In this subsection, we detail with a greater attention some of the results we thought of interest, regarding the economic cycle dependence and the effects of the outliers on the estimations.

3.3.1 The economic cycle effect

We found several types of statistical effects linked to the introduction of the threshold variables that we thought of equal importance. As we initially used these variables for, we came to be able to separate the bond market reaction function to announcements during expansion and recession cycles. Three types of results arose: first, some announcements were found to have a sharper effect on the yield curve during either the recession or the expansion period, matching in both these cases the same factor pattern. Second, some announcements seemed to have an effect during only one of those periods, and no effect during the other one. Third, a few announcements were found to have a different type of effect on the yield curve, depending upon the threshold variable. In such a case, the global stance of the economy not only influences the strength of the market response to some surprises: it also brings about a change in the type of term structure of the rates' response to surprises. We propose hereafter some examples of these statistical effects that we found within

our estimations.

First, some of the figures were found to have a sharper effect on the changes in US swap rates when the threshold variable lies below or above the estimated threshold. What is more, the average effect of the announcement usually under- or over-estimates the actual term structure of the swap rates' response. The announcement of Non-farm Payroll is a good example of such a pattern. As presented in figure 2, the average effect (i.e. estimated with model 1) of the announcement lies typically below (above) the one obtained when considering the sample for which the threshold variable lies above (below) the estimated threshold. This has important implications for the building of interest rates models, both for professionals of finance and for monetary policy makers: the Non Farm Payroll (NFPR hereafter) figure is not that closely monitored by financial markets during slowdown periods, but is of tremendous importance during expansion ones. What is more, the term structure reaction matches factor 1 for both cases, suggesting that this variable is interpreted by financial markets as monetary policy driving figure.

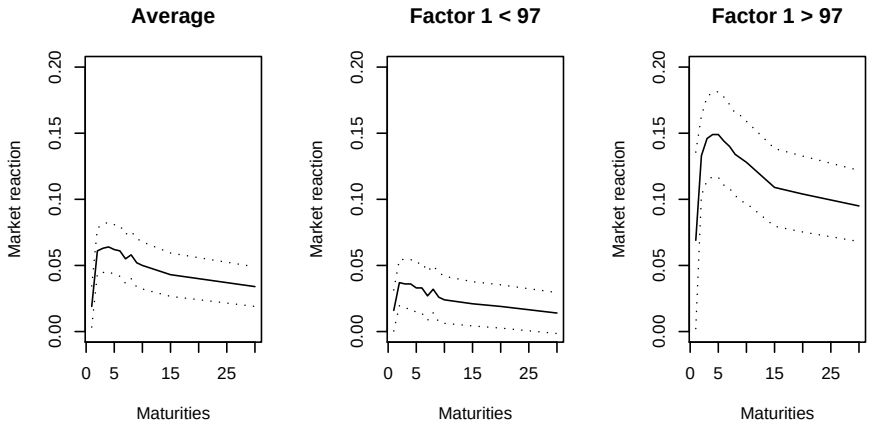

Figure 2: Swap rates reaction function to a positive surprise for Non Farm Payroll (plain line) and 95% confidence intervals (dotted lines).

Second, for some figures, only one period includes a significative term structure reaction of the US swap rate. The average effect (estimated with model 1) is not significative and only one of the two states associated to model 3 yields significative estimates. The Capacity Utilization Rate is an example of this phenomenon: when the Fed's target rate is above 3.5%, the term structure effect is globally equal to zero. On the contrary, when the target rate is below 3.5%, one gets an important hump-shaped reaction function. This effect is presented in figure 3. Again, this has important implications for the understanding of the reaction of interest rates to macroeconomic announcements. What is more, this type of effect could explain the fact that high-frequency dataset led to the finding of more market mover figures than the daily ones.

Finally, the most striking effect is for figures that lead to different types of shapes of the term structure responses, depending upon the level of the threshold variable. Until now, we simply underlined figures for which we found the same term structure effect across the different values of the threshold variable. But for some figures, the term structure effect seems to depend on the state of the economy. This means that the interpretation of the signal driven by these variables is state-dependent. One example of such pattern is the Construction Spending figure. Figure 4 presents the different patterns of the term structure reaction of the swap rates to positive surprises, depending on whether the Philifed index is above or below 2. Philifed Index

is a sentiment survey. Depending upon the threshold variable, we obtain two different patterns: a positive reaction function that is close to the factor 3 shape when the Philifed is above 2 and a negative hump-shaped one that is close to the factor 1 pattern when the Philifed is below 2. This means that the market perception of construction spendings strongly depends on the state of the economy.

3.3.2 The outliers effect

Some recent papers using high frequency datasets (e.g. Fleming and Remolona (2001)) found a greater number of market mover figures than usually found in daily datasets. Our estimations results produced one possible explanation for this phenomenon. The existence of outliers within the changes in the swap rates across maturities leads to biased estimations of the term structure reaction. This is in line with what has been said in the previous section: the sample splitting produced by the introduction of a threshold variable led to the assessment of an over- or under-estimation of the bond market reaction function. This phenomenon is often referred to as *aliasing*, and is well known and diagnosed using jump models (see e.g. Andersen et al.

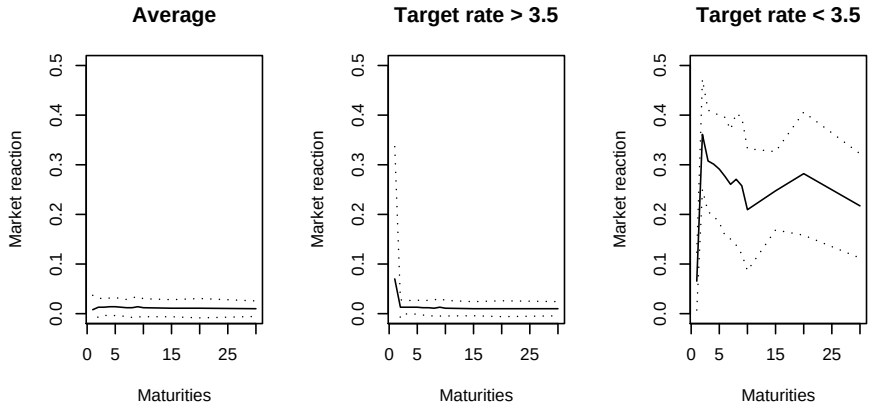

Figure 3: Swap rates reaction function to a positive surprise for Capacity Utilization Rate (plain line) and 95% confidence intervals (dotted lines).

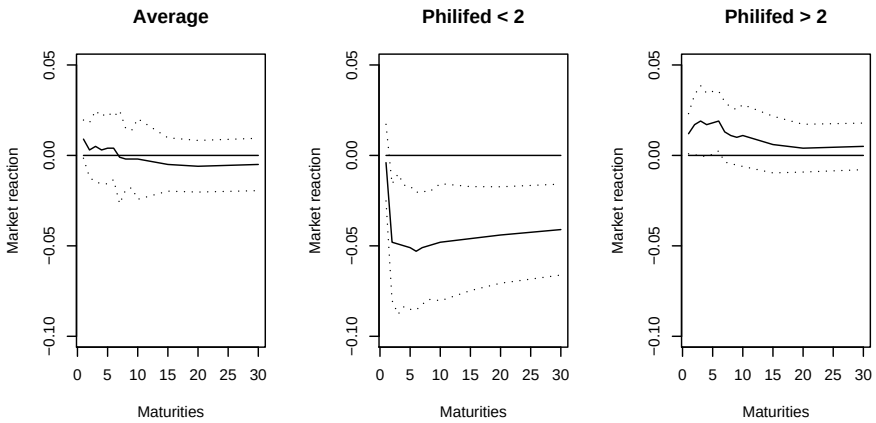

Figure 4: Swap rates reaction function to a positive surprise for Construction Spending (plain line) and 95% confidence intervals (dotted lines).

(2003a)). Note that Andersen et al. (2003a) directly encourage empirical papers investigating the types of issue we are faced with[6].

These outliers generally appear when the global economic stance of the US is very high or very low, that is to say close to turning points in the economy. Bond markets seem to have odd reactions when getting near these turning points. In fact, one can assume that during these periods, the expectations of bond market participant are very sensitive to any breaking news in the economy. Turning points in the economy are very important in so far as they match the inversion of the central bank policy. When the Fed comes to the end of a tightening cycle, the turning point will trigger the beginning of an easing cycle of the monetary policy and a progressive reduction of the target rate. In this perspective, the forward rates, and thus the spot rates are very sensitive to these changes in economic perspectives.

The estimation results presented in tables 6, 7 and 8 point toward the fact that getting rid of these outliers brings about a reduction of the estimation bias in the bond markets' term structure reaction function. Here again, we found three types of effects: a first one for which we observed an underestimation of the rates' reaction function to macroeconomic announcements, when the effect of the announcement were already considered significant for model 1; a second one that is related to announcements for which the response is primarily found not to be significative when the outliers are maintained in the dataset, and significative if not; a third one, for which, in case of extreme economic situation, the market seems to have an significative reaction function.

First, when the sample splitting leads to the elimination of a few outliers, the estimated term structure reaction function may be more important for the sample that excludes the outliers. This is for example the case of the Durable Good Orders and of the Philifed Index. When estimating the swap rate reaction function to such announcements with model 1, one would find significative estimates. Nevertheless, the estimates obtained in the threshold model are more significant and present a superior absolute value, when the selected threshold variable is above or below the estimated threshold value. Figure 5 presents the term structure reaction to the announcement of the Durable Good Orders, when the Fed fund target rate is below or above 2%.

Secondly, the estimation of the impact of some of the studied figures leads to the finding of no remarkable effect on the yield curve when using model 1. The exclusion of the outliers from the dataset then brings about very different estimation results, suggesting that the first estimates were biased because of the presence of these extreme values. Good examples of this fact are the Unemployment Rate and the Weekly Working Hours. Without the sample splitting process, one would conclude with the fact that these announcements do not have any effect on swap rates. When implementing our methodology, we find that the shape and the significativeness of the term structure's reaction function of the swap rates is clearly very different. In figure 6 we present the term structure of the announcement effect of the Weekly Working Hours on the swap rates curve, documenting what has just been said.

Finally, a last type of effects appeared in the estimation results: some of the studied figures produce no significative effect on the yield curve when estimating model 1, but during very special occasions can have a dramatic impact across maturities. For a few outliers, the response of the swap rates is again important and hump-shaped. The Industrial Orders figure is a good example of such a pattern: the model presented in Section 2 that maximized the log-likelihood was the one using the PMI (Purchasing Manager Index) as a threshold variable. When the PMI index is below 42, which is rarely the case, the term structure of the rates' reaction is significative for each maturity. On the contrary, when the PMI is above 42, we did not find any

[6]Here is the quote taken from Andersen et al. (2003a): *"These daily jump proportions are much higher than the jump intensities typically estimated with specific parametric jump diffusion models applied to daily or coarser frequency returns. This suggests that many of the jumps identified by the high-frequency based realized volatility measures employed here may be blurred in the coarser daily or lower frequency returns through an aliasing type phenomenon. [...] The fixed income market is generally the most responsive to macroeconomic news announcements (e.g., Andersen et al. (2003b)). Along these lines, it would be interesting, but beyond the scope of the present paper, to directly associate the significant jumps identified here with specific news arrivals, including regularly-scheduled macroeconomic news releases."*

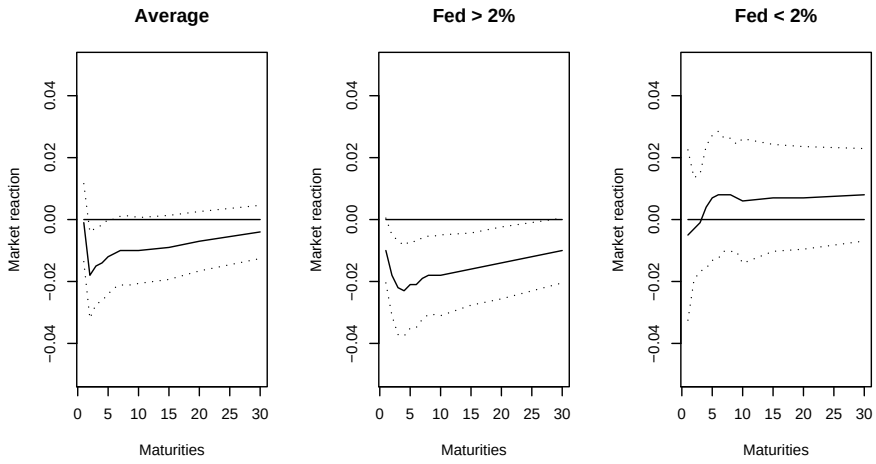

Figure 5: Swap rates reaction function to a positive surprise for Durable Goods Orders (plain line) and 95% confidence intervals (dotted lines).

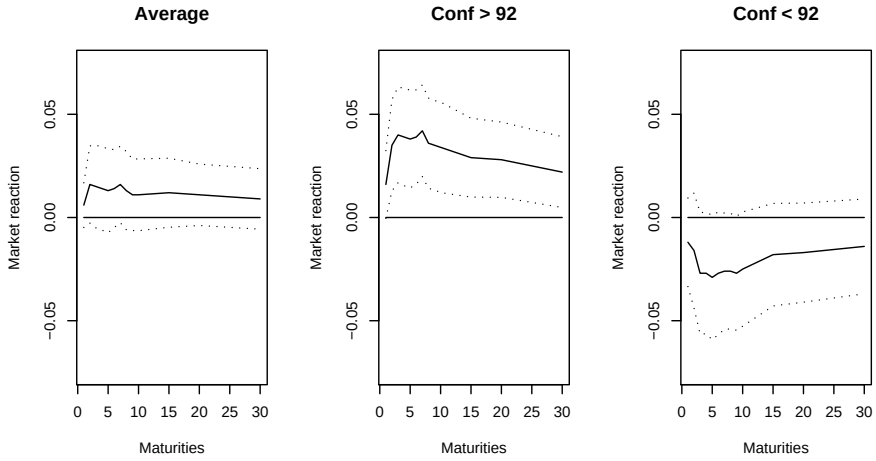

Figure 6: Swap rates reaction function to a positive surprise for Weekly Working Hours (plain line) and 95% confidence intervals (dotted lines).

observable effect. This is presented in figure 7. One should remain cautious regarding the interpretation of this finding. The few observations for this type of event makes it hard to be very conclusive. Nevertheless, the fact we have again a hump-shaped reaction function tends to support the idea that industrial orders are a closely-watched figure in financial markets when getting closer to the end of the slowdown cycle of the economy.

Conclusion

The aim of this paper was to estimate a collection of nested time series models for data-mining purposes. We found several new results. First, the use of a threshold model for the analysis of the term structure effect of

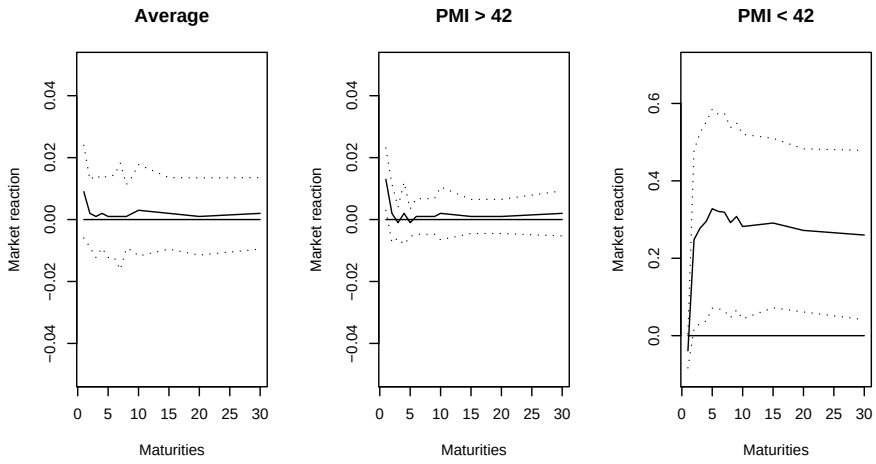

Figure 7: Swap rates reaction function to a positive surprise for Industrial Orders (plain line) and 95% confidence intervals (dotted lines).

macroeconomic announcements yields a much longer list of market mover figures. Second, we found that the classical hump-shaped term structure reaction function of interest rates to market mover announcements was not the only existing shape. At least three to four shapes may have to be considered, surprisingly matching that of the first four factors of a PCA performed over the daily changes in the shape rates. We develop a distance measure to build a classification of the term structure effect of announcements on the yield curve. Third, we found that the introduction of a state variable often leads to a better understanding of the reaction function to most of the announcements. When the economy is slowing or roaring, the impact of the surprises in the announcements is obviously not the same. It can even change the shape of the term structure reaction itself. Fourth, the sample splitting used throughout the paper make it possible to isolate a few outliers and to analyse the rates dynamics on each sample separately. The results point toward the fact that these outliers often bring about an underestimation of the reaction function.

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		1 year			2 year			3 year			4 year			5 year		
		Intercept	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**
Household consumption	**Estimate**	-0,013	-0,052	-0,002	0,008	0,004	-0,023	0,013**	0,007	-0,017	0,01*	0,003	-0,016	0,007	0,004	-0,017
	Th. Variable/Th/p-val	*CONF*	*140,316*	*0,17*	*PMI*	*42,305*	*0,04*	*PHI*	*-2,605*	*0,04*	*PHI*	*-2,605*	*0,1*	*PMI*	*48,568*	*0,08*
Personal Income	**Estimate**	-0,017	0,093*	0	0,009*	0,004	-0,071	0,012**	0,045**	-0,002	0,01*	0,045**	-0,002	0,007	0,042**	0
	Th. Variable/Th/p-val	*MICH*	*108,305*	*0,06*	*FACT1*	*61,227*	*0*	*FACT1*	*94,128*	*0,01*	*FACT1*	*94,128*	*0*	*FACT1*	*94,128*	*0,02*
ISM manuf	**Estimate**	-0,013	0,08**	0,014**	0,011**	0,119**	0,024**	0,009	0,05**	-0,003	0,013**	0,136**	0,028**	0,008	0,049**	0
	Th. Variable/Th/p-val	*FED*	*6,211*	*0,01*	*FED*	*6,211*	*0*	*MICH*	*86,137*	*0*	*FED*	*6,211*	*0*	*MICH*	*86,137*	*0*
Industrial New orders	**Estimate**	-0,024	0,013*	-0,039	-0,001	0,001	0,235**	-0,001	0,003	-0,095	-0,001	0,006	-0,102	-0,001	0,003	-0,106
	Th. Variable/Th/p-val	*PMI*	*43,832*	*0,06*	*PHI*	*-14,037*	*0,01*	*CONF*	*78,937*	*0,02*	*CONF*	*78,937*	*0,01*	*CONF*	*78,937*	*0,01*
Construction Spending	**Estimate**	-0,032	0,015	0,267**	0	-0,021	0,057**	0	-0,05	0,04	-0,001	-0,044	0,041	0,004	0,015	-0,18
	Th. Variable/Th/p-val	*PMI*	*43,758*	*0,05*	*MICH*	*104,758*	*0,04*	*FACT1*	*90,732*	*0,02*	*FACT1*	*90,732*	*0,04*	*FACT1*	*68,668*	*0,01*
Consumer Credit	**Estimate**	-0,018	-0,003	-0,253	0,005	-0,567	-0,003	0,001	-0,589	-0,001	0	-0,613	0,001	0,003	-0,589	-0,001
	Th. Variable/Th/p-val	*PMI*	*41,189*	*0*	*PHI*	*31,689*	*0*	*PHI*	*31,689*	*0*	*PHI*	*31,689*	*0*	*PHI*	*31,689*	*0*
Wholesale Inventory	**Estimate**	-0,014	-0,001	0,067**	0,001	0,003	0,044**	0,001	0	0,048**	0	0,002	0,061**	0	0,004	0,061**
	Th. Variable/Th/p-val	*PMI*	*50,916*	*0*	*PHI*	*-10,226*	*0,06*	*PHI*	*-10,226*	*0,05*	*PHI*	*-10,226*	*0,02*	*PHI*	*-10,226*	*0,02*
Retail Sales	**Estimate**	-0,01	-0,233	0,012*	-0,001	0,094**	0,007	0,001	0,026**	-0,013	0,002	0,022**	-0,025	0,003	0,025**	-0,021
	Th. Variable/Th/p-val	*MICH*	*110,011*	*0*	*FED*	*6,211*	*0,01*	*MICH*	*84,147*	*0,02*	*MICH*	*80,168*	*0,03*	*MICH*	*80,168*	*0,03*
Industrial Production	**Estimate**	-0,019	-0,059	0,028**	-0,002	0,006	0,081**	-0,004	0,007	0,068**	-0,006	0,006	0,069**	-0,004	0,009	0,071**
	Th. Variable/Th/p-val	*CONF*	*140,316*	*0,01*	*PHI*	*-14,037*	*0*	*PHI*	*-14,037*	*0*	*PHI*	*-14,037*	*0*	*PHI*	*-14,037*	*0*
Housing Start	**Estimate**	-0,016	0	-0,005	-0,001	0	-0,006	-0,007	0	-0,005	-0,008	0	-0,004	-0,005	0	-0,004
	Th. Variable/Th/p-val	*FACT1*	*68,538*	*0*	*FACT1*	*68,538*	*0*	*PHI*	*-6,416*	*0*	*PHI*	*-6,416*	*0*	*PHI*	*-6,416*	*0*
Philifed Index	**Estimate**	-0,01	0,022**	-0,199	0,001	0,021**	0,59**	0,004	0,021**	0,596**	0,004	0,022**	0,598**	0,003	0,02**	0,587**
	Th. Variable/Th/p-val	*PMI*	*42,579*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*
Existing Home Sales	**Estimate**	-0,006	0	0,798**	0,006	0,001	0,36**	0,007	0,001*	0,312*	0,007	0,001	0,037*	0,006	0,001	0,051**
	Th. Variable/Th/p-val	*FACT1*	*53,916*	*0,01*	*PMI*	*49,526*	*0,04*	*PMI*	*49,526*	*0,07*	*MICH*	*100,063*	*0,06*	*MICH*	*100,063*	*0,01*
Conf. Board Consumer Conf.	**Estimate**	-0,01	0,06**	0,003	-0,015	0,038**	0	-0,012	0,039**	-0,002	-0,01	0,035**	-0,003	-0,006	-0,003	0,039**
	Th. Variable/Th/p-val	*FED*	*6,211*	*0*	*FED*	*3,605*	*0*	*FED*	*3,605*	*0*	*FED*	*3,605*	*0*	*PMI*	*49,526*	*0*
GDP	**Estimate**	-0,01	-0,02	0,002	-0,001	-0,029	0,034**	-0,006	-0,032	0,031**	-0,004	-0,034	0,029*	-0,001	-0,025	0,04**
	Th. Variable/Th/p-val	*PMI*	*54,337*	*0,02*	*FACT1*	*85,497*	*0*	*FACT1*	*85,497*	*0*	*FACT1*	*85,497*	*0*	*FACT1*	*85,497*	*0*
Chicago PMI	**Estimate**	-0,022	0,008**	-0,001	-0,023	0,004*	0,014**	-0,026	0,004*	0,015**	-0,026	0,004*	0,014**	-0,025	0,004*	0,014**
	Th. Variable/Th/p-val	*FACT2*	*-126,922*	*0,01*	*MICH*	*94,095*	*0*	*MICH*	*94,095*	*0*	*MICH*	*94,095*	*0*	*MICH*	*94,095*	*0,01*
New Home Sales	**Estimate**	-0,015	0,008	-0,249	-0,011	0,01*	-0,41	-0,012	0,013**	-0,373	-0,009	0,014**	-0,382	-0,006	0,013**	-0,36
	Th. Variable/Th/p-val	*PMI*	*42,305*	*0*	*PHI*	*-21,658*	*0*	*PHI*	*-21,658*	*0*	*PHI*	*-21,658*	*0*	*PMI*	*41,053*	*0,01*
Consumer Price Index	**Estimate**	-0,018	0,027**	-0,011	-0,005	0,007	0,143**	-0,006	0,008	0,149**	-0,009	0,008	0,155**	-0,005	0,008	0,142**
	Th. Variable/Th/p-val	*MICH*	*98,074*	*0*	*CONF*	*78,937*	*0*	*CONF*	*78,937*	*0*	*CONF*	*78,937*	*0*	*CONF*	*78,937*	*0,01*
Unemployment Rate	**Estimate**	-0,024	-0,03	0,01	-0,003	0,128**	-0,022	0,001	0,148**	-0,02	0	0,154**	-0,02	0,004	0,152**	-0,016
	Th. Variable/Th/p-val	*FACT2*	*-123,04*	*0*	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*
Trade Balance	**Estimate**	-0,01	-0,001	0,722*	-0,002	0,008	1,077**	-0,003	0,013*	0,971**	-0,003	0,034**	0,002	-0,004	0,036**	0
	Th. Variable/Th/p-val	*PHI*	*-26,126*	*0,06*	*PHI*	*-26,126*	*0,01*	*PHI*	*-26,126*	*0,03*	*FACT2*	*-112,93*	*0,04*	*FACT2*	*-112,93*	*0,01*
Jobless Claims	**Estimate**	-0,011	0	-0,015	0	-0,01	-0,094	-0,001	-0,01	-0,094	0	-0,01	-0,091	0	-0,01	-0,087
	Th. Variable/Th/p-val	*PHI*	*5,016*	*0,01*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*
Non Farm Payroll	**Estimate**	-0,016	0,005	0,033**	0,003	0,133**	0,037**	0,006	0,146**	0,036**	0,004	0,149**	0,036**	0,008	0,149**	0,033**
	Th. Variable/Th/p-val	*MICH*	*98,074*	*0,07*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*
Capacity Utilization Rate	**Estimate**	-0,052	0,007	1,639**	-0,008	0,013*	9,031**	-0,01	0,013*	7,691**	-0,012	0,013*	7,531**	-0,011	0,013*	7,28**
	Th. Variable/Th/p-val	*FED*	*5,447*	*0,03*	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*
Employment Cost Index	**Estimate**	-0,006	-0,006	0,018**	-0,001	0,059**	-0,001	0,004	0,057**	0,001	0,007	0,054**	0	0,002	0,073**	0,015
	Th. Variable/Th/p-val	*PHI*	*6,221*	*0,01*	*FACT1*	*86,592*	*0,01*	*CONF*	*108,353*	*0,01*	*CONF*	*108,353*	*0,01*	*FED*	*5,342*	*0*
Wages	**Estimate**	-0,043	0,008**	-0,002	-0,005	0,007	-0,002	-0,011	-0,002	0,009**	-0,013	-0,002	0,011**	-0,009	-0,002	0,012**
	Th. Variable/Th/p-val	*CONF*	*141,274*	*0,02*	*FED*	*6,224*	*0,05*	*FACT1*	*65,128*	*0,02*	*FACT1*	*65,128*	*0*	*FACT1*	*65,128*	*0,01*
Productivity	**Estimate**	-0,005	0,012	-0,19	-0,001	0,038*	-0,011	-0,001	-0,001	-0,1	-0,007	0,035	-0,016	-0,007	0,036	-0,009
	Th. Variable/Th/p-val	*PMI*	*41,053*	*0,01*	*PMI*	*58,589*	*0,02*	*PHI*	*-14,037*	*0,01*	*PMI*	*58,589*	*0,04*	*PMI*	*58,589*	*0,07*
Durable Good Orders	**Estimate**	0	0,016**	-0,023	0,004	-0,046	-0,001	-0,008	-0,219	-0,013	-0,006	-0,217	-0,012	-0,004	-0,199	-0,01
	Th. Variable/Th/p-val	*FACT1*	*81,258*	*0*	*FACT2*	*-111,393*	*0,01*	*PMI*	*64,811*	*0,01*	*PMI*	*64,811*	*0*	*PMI*	*64,811*	*0,01*
Producer Price Index	**Estimate**	-0,008	-0,024	0,002	-0,001	0,002	-0,027	-0,004	0,001	-0,025	-0,005	0	-0,025	-0,007	0,001	-0,025
	Th. Variable/Th/p-val	*FED*	*5,921*	*0,03*	*PHI*	*-14,037*	*0*	*PHI*	*-14,037*	*0,01*	*PHI*	*-14,037*	*0,01*	*PHI*	*-14,037*	*0,01*
Hourly Average Wages	**Estimate**	-0,016	0,016	-0,024	0,005	0,093**	-0,004	0,008	0,1**	-0,003	0,006	0,103**	-0,003	0,01	0,108**	-0,003
	Th. Variable/Th/p-val	*MICH*	*92,105*	*0,02*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*
Non Manuf. ISM	**Estimate**	0,001	-0,008	0,053**	-0,006	0,005	0,067**	-0,004	0,007	0,067**	-0,002	0,001	0,062**	0,001	0,006	0,063**
	Th. Variable/Th/p-val	*PMI*	*45,358*	*0*	*PHI*	*-14,037*	*0*	*PHI*	*-14,037*	*0*	*FACT1*	*64,883*	*0*	*FACT1*	*64,883*	*0*
Weekly Working Hours	**Estimate**	-0,006	0,061**	0,002	0,001	-0,011	0,042**	0,005	-0,02	0,048**	-0,002	0,039**	-0,027	0,002	0,038**	-0,029
	Th. Variable/Th/p-val	*PHI*	*27,879*	*0,01*	*FACT2*	*-115,275*	*0,01*	*FACT2*	*-115,275*	*0*	*CONF*	*92,089*	*0*	*CONF*	*92,089*	*0*
Consumer Conf. Michigan	**Estimate**	0	0,02**	-0,004	0,003	0,02**	-0,008	0,001	0,003	0,048**	-0,002	0,003	0,049**	-0,002	0,003	0,05**
	Th. Variable/Th/p-val	*CONF*	*109,626*	*0,01*	*MICH*	*92,105*	*0,01*	*FACT1*	*61,227*	*0,01*	*FACT1*	*61,227*	*0,01*	*FACT1*	*61,227*	*0,01*
GDP after 1999	**Estimate**	-0,005	0,008	0,101**	-0,009	-0,146	0,015*	-0,007	-0,145	0,018**	-0,007	-0,144	0,019**	-0,01	0,015*	0,088**
	Th. Variable/Th/p-val	*PMI*	*45,358*	*0*	*MICH*	*108,021*	*0,01*	*MICH*	*108,021*	*0,02*	*MICH*	*108,021*	*0,02*	*PMI*	*43,968*	*0,04*
Weekly Jobless Claims	**Estimate**	0,006**	-0,001	0,012	0,002	0	0,012*	0,002	0	0,012*	0,002	-0,001	0,014*	0,001	0	0,017**
	Th. Variable/Th/p-val	*PHI*	*-5,616*	*0,1*	*FACT1*	*81,692*	*0,1*	*FACT1*	*81,692*	*0,1*	*FACT1*	*81,692*	*0,06*	*FACT1*	*81,692*	*0,04*
Building Permits	**Estimate**	0,012**	-0,026	0,002	-0,004	0,003	0,074**	-0,009	0,002	0,092**	-0,006	-0,001	0,094**	-0,009	-0,001	0,103**
	Th. Variable/Th/p-val	*PHI*	*28,647*	*0,02*	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*
Empire Manufacturing	**Estimate**	0,009**	-0,006	0,007**	0,011	-0,009	0,02**	0,014	-0,016	0,02*	0,011	-0,007	0,02	0,019	0,009	-0,09
	Th. Variable/Th/p-val	*FACT1*	*96,422*	*0,02*	*PMI*	*55,253*	*0,09*	*PMI*	*55,253*	*0,08*	*PMI*	*55,253*	*0,23*	*MICH*	*75,758*	*0,37*
Personal Consumption	**Estimate**	0,011*	0,072**	-0,003	-0,01	0,071*	0,008	-0,007	0,077*	0,015	-0,005	0,024**	-0,018	-0,006	0,024**	-0,044
	Th. Variable/Th/p-val	*MICH*	*96,011*	*0,01*	*MICH*	*96,011*	*0,11*	*MICH*	*96,011*	*0,18*	*PHI*	*6,968*	*0,16*	*FACT1*	*71,872*	*0,16*
Indice Help Wanted	**Estimate**	0,016**	0	0,065**	0,004	-0,013	0,024**	0,009	-0,018	0,031**	0,011	-0,017	0,032**	0,01	-0,018	0,033**
	Th. Variable/Th/p-val	*CONF*	*77,905*	*0,03*	*FED*	*3,395*	*0,03*	*FED*	*3,395*	*0,01*	*FED*	*3,395*	*0,01*	*FED*	*3,395*	*0,01*
NAHB Housing Market Index	**Estimate**	0,011**	0,023**	0	-0,001	0,052**	0,004	0,002	0,056**	-0,002	-0,008	0,042**	-0,012	-0,01	0,042**	-0,019
	Th. Variable/Th/p-val	*FACT2*	*-101,575*	*0*	*FACT2*	*-101,575*	*0,01*	*FACT2*	*-101,575*	*0*	*PHI*	*11,358*	*0*	*PHI*	*11,358*	*0*
Construction Spending	**Estimate**	0,007*	0,005	0,11**	0,006	0,017**	-0,048	0,012	0,019*	-0,049	0,01	0,017*	-0,05	0,013	0,018**	-0,051
	Th. Variable/Th/p-val	*PMI*	*53,737*	*0*	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*

Table 6: Results of the estimation of the threshold model, using the best performing threshold variable. * is for significative variable at 10% level and ** is for 5% level. (a)

		6 year			7 year			8 year			9 year			10 year		
		Intercept	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**
Household consumption	**Estimate**	0,011**	0,003	-0,014	0,011*	0,006	-0,012	0,015**	-0,023	0,003	0,015**	-0,021	0,003	0,012**	-0,022	0,002
	Th. Variable/Th/p-val	*PMI*	*48,568*	*0,14*	*PMI*	*49,821*	*0,11*	*FED*	*4,763*	*0,09*	*FED*	*4,763*	*0,11*	*FED*	*4,763*	*0,11*
Personal Income	**Estimate**	0,011**	0,053**	-0,002	0,01*	0,048**	-0,002	0,012**	0,045**	-0,003	0,013**	0,043**	-0,002	0,009*	0,041**	-0,001
	Th. Variable/Th/p-val	*FACT1*	*94,128*	*0*	*FACT1*	*94,128*	*0*	*FACT1*	*94,128*	*0*	*FACT1*	*94,128*	*0,01*	*FACT1*	*94,128*	*0,01*
ISM manuf	**Estimate**	0,016**	0,128**	0,032**	0,016**	0,129**	0,03**	0,016**	0,125**	0,029**	0,016**	0,124**	0,03**	0,018**	0,122**	0,027**
	Th. Variable/Th/p-val	*FED*	*6,211*	*0*	*FED*	*6,211*	*0*	*FED*	*6,211*	*0*	*FED*	*6,211*	*0*	*FED*	*6,211*	*0*
Industrial New orders	**Estimate**	0,002	0,004	-0,106	0	0,004	-0,104	0,003	0,004	-0,101	0,001	0,005	-0,101	-0,002	0,006	-0,102
	Th. Variable/Th/p-val	*CONF*	*78,937*	*0,01*	*CONF*	*78,937*	*0,01*	*CONF*	*78,937*	*0,01*	*CONF*	*78,937*	*0,01*	*CONF*	*78,937*	*0,01*
Construction Spending	**Estimate**	0,006	0,009	-0,178	0,005	0,01	-0,175	0,004	0,014	-0,155	0,006	0,011	-0,16	0,005	0,018	-0,15
	Th. Variable/Th/p-val	*FACT1*	*68,668*	*0,01*	*FACT1*	*68,668*	*0,01*	*FACT1*	*68,668*	*0,01*	*FACT1*	*68,668*	*0,01*	*FACT1*	*68,668*	*0,01*
Consumer Credit	**Estimate**	0,004	-0,156	0,001	-0,001	-0,514	-0,001	0,004	-0,491	0	-0,001	-0,465	-0,001	0	-0,459	-0,002
	Th. Variable/Th/p-val	*PHI*	*27,879*	*0*	*PHI*	*31,689*	*0*	*PHI*	*31,689*	*0*	*PHI*	*31,689*	*0*	*PHI*	*31,689*	*0*
Wholesale Inventory	**Estimate**	0	0,014*	-0,45	-0,004	0,008	-0,383	-0,002	-0,003	0,028**	-0,005	0,03**	-0,002	0,002	0	0,059**
	Th. Variable/Th/p-val	*PMI*	*41,189*	*0,01*	*PMI*	*41,189*	*0,04*	*FACT2*	*-134,687*	*0,03*	*CONF*	*114,011*	*0,02*	*PHI*	*-10,226*	*0,02*
Retail Sales	**Estimate**	0,002	0,089**	0,014*	0,001	0,028**	-0,008	0,004	0,023**	-0,021	0,004	0,048**	0,008	0	0,05**	0,008
	Th. Variable/Th/p-val	*FED*	*6,211*	*0,03*	*MICH*	*88,126*	*0,03*	*MICH*	*80,168*	*0,03*	*CONF*	*122,779*	*0,04*	*CONF*	*122,779*	*0,03*
Industrial Production	**Estimate**	-0,003	0,011	0,068**	-0,006	0,009	0,065**	-0,004	0,011	0,066**	-0,007	-0,009	0,029**	-0,011	-0,008	0,027**
	Th. Variable/Th/p-val	*PHI*	*-14,037*	*0,01*	*PHI*	*-14,037*	*0,01*	*PHI*	*-14,037*	*0,01*	*PMI*	*56,474*	*0,01*	*PMI*	*56,474*	*0,02*
Housing Start	**Estimate**	-0,005	0	-0,006	-0,007	0	-0,004	-0,008	0	-0,004	-0,009	0	-0,004	-0,009	0	-0,005
	Th. Variable/Th/p-val	*PMI*	*45,358*	*0,01*	*PHI*	*-6,416*	*0*	*PHI*	*-6,416*	*0,01*	*PHI*	*-6,416*	*0,01*	*CONF*	*78,937*	*0,01*
Philifed Index	**Estimate**	0,001	0,021**	0,587**	-0,001	0,02**	0,572**	-0,001	0,018**	0,48**	0	0,018**	0,571**	-0,004	0,015**	0,568**
	Th. Variable/Th/p-val	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*
Existing Home Sales	**Estimate**	0,015*	0,001	1,347**	0,014*	0,001	1,284**	0,018**	0,001	1,279**	0,016*	0,001	1,25**	0,005	0,001*	0,052**
	Th. Variable/Th/p-val	*PMI*	*46,747*	*0*	*PMI*	*46,747*	*0*	*PMI*	*46,747*	*0*	*PMI*	*46,747*	*0,01*	*MICH*	*100,063*	*0,01*
Conf. Board Consumer Conf.	**Estimate**	-0,006	-0,003	0,038**	-0,003	-0,002	0,039**	-0,004	-0,003	0,037**	-0,004	-0,003	0,039**	-0,005	0,006	0,065**
	Th. Variable/Th/p-val	*PMI*	*49,526*	*0*	*PMI*	*49,526*	*0*	*PMI*	*49,526*	*0*	*PMI*	*49,526*	*0*	*PMI*	*43,968*	*0*
GDP	**Estimate**	-0,002	-0,03	0,029**	-0,01	-0,03	0,033*	-0,004	-0,027	0,021	-0,005	-0,029	0,021	-0,018	-0,029	0,025
	Th. Variable/Th/p-val	*FACT1*	*85,497*	*0*	*FACT1*	*85,497*	*0*	*FACT1*	*85,497*	*0,01*	*FACT1*	*85,497*	*0,01*	*FACT1*	*85,497*	*0,01*
Chicago PMI	**Estimate**	-0,026	0,005**	0,014**	-0,026	0,004*	0,013**	-0,023	0,005**	0,013**	-0,023	0,005**	0,013**	-0,027	0,004*	0,012**
	Th. Variable/Th/p-val	*MICH*	*94,095*	*0,02*	*MICH*	*94,095*	*0,01*	*MICH*	*94,095*	*0,03*	*MICH*	*94,095*	*0,03*	*MICH*	*94,095*	*0,03*
New Home Sales	**Estimate**	-0,007	0,015**	-0,333	-0,007	0,015**	-0,317	-0,007	0,049**	0,007	-0,007	0,051**	0,007	-0,009	0,053**	0,008
	Th. Variable/Th/p-val	*PHI*	*-21,658*	*0,01*	*PHI*	*-21,658*	*0,01*	*MICH*	*102,053*	*0,01*	*MICH*	*102,053*	*0,01*	*MICH*	*102,053*	*0,01*
Consumer Price Index	**Estimate**	-0,008	0,011*	0,148**	-0,009	0,007	0,144**	-0,007	0,008	0,132**	-0,006	0,035**	0	-0,011	0,008	0,118**
	Th. Variable/Th/p-val	*CONF*	*78,937*	*0,01*	*CONF*	*78,937*	*0,01*	*CONF*	*78,937*	*0,01*	*MICH*	*98,074*	*0,01*	*CONF*	*78,937*	*0,02*
Unemployment Rate	**Estimate**	0,003	0,149**	-0,018	0,003	0,145**	-0,016	0,005	0,14**	-0,014	0	0,136**	-0,015	0,001	0,138**	-0,014
	Th. Variable/Th/p-val	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*
Trade Balance	**Estimate**	-0,005	0,039**	-0,001	-0,003	0,039**	-0,002	-0,006	0,041**	-0,001	-0,006	0,041**	-0,001	-0,01	0,043**	0,001
	Th. Variable/Th/p-val	*FACT2*	*-109,378*	*0,01*	*FACT2*	*-109,378*	*0,01*	*FACT2*	*-109,378*	*0*	*FACT2*	*-109,378*	*0*	*FACT2*	*-109,378*	*0*
Jobless Claims	**Estimate**	0	-0,01	-0,085	-0,002	-0,009	-0,083	0	-0,009	-0,076	0	-0,009	-0,08	-0,003	-0,007	-0,08
	Th. Variable/Th/p-val	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*
Non Farm Payroll	**Estimate**	0,007	0,144**	0,033**	0,006	0,14**	0,027**	0,009	0,134**	0,032**	0,003	0,131**	0,026**	0,003	0,128**	0,024**
	Th. Variable/Th/p-val	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*
Capacity Utilization Rate	**Estimate**	-0,006	0,012	6,917**	-0,012	0,012	6,515**	-0,008	0,011	6,769**	-0,011	0,013	6,442**	-0,018	0,011	5,238**
	Th. Variable/Th/p-val	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*
Employment Cost Index	**Estimate**	0,002	0,07**	0,017	0	0,064**	0,014	-0,001	0,062**	0,015	-0,003	0,063**	0,017	-0,004	0,058**	0,013
	Th. Variable/Th/p-val	*FED*	*5,342*	*0,01*	*FED*	*5,342*	*0,02*	*FED*	*5,342*	*0,03*	*FED*	*5,342*	*0,04*	*FED*	*5,342*	*0,03*
Wages	**Estimate**	-0,009	-0,002	0,012**	-0,012	-0,002	0,012**	-0,006	-0,002	0,014**	-0,008	-0,002	0,014**	-0,013	-0,001	0,013**
	Th. Variable/Th/p-val	*FACT1*	*65,128*	*0,01*	*FACT1*	*65,128*	*0*	*FACT1*	*65,128*	*0,01*	*FACT1*	*65,128*	*0*	*FACT1*	*65,128*	*0,01*
Productivity	**Estimate**	-0,004	-0,003	-0,139	-0,005	-0,005	-0,123	-0,003	-0,004	-0,117	-0,004	-0,005	-0,101	-0,007	-0,004	-0,088
	Th. Variable/Th/p-val	*PHI*	*-14,037*	*0*	*PHI*	*-14,037*	*0,01*	*PHI*	*-14,037*	*0,01*	*PHI*	*-14,037*	*0,02*	*PHI*	*-14,037*	*0,04*
Durable Good Orders	**Estimate**	-0,002	-0,184	-0,009	-0,001	-0,176	-0,008	0,001	0,001	-0,034	-0,002	-0,009	-0,452	-0,004	-0,009	-0,551
	Th. Variable/Th/p-val	*PMI*	*64,811*	*0,01*	*PMI*	*64,811*	*0,01*	*PHI*	*-12,321*	*0,01*	*PHI*	*-25,984*	*0,01*	*PHI*	*-25,984*	*0*
Producer Price Index	**Estimate**	-0,007	0	-0,025	-0,006	0	-0,023	-0,006	0	-0,022	-0,006	0	-0,02	-0,009	0	-0,017
	Th. Variable/Th/p-val	*PHI*	*-14,037*	*0,02*	*PHI*	*-14,037*	*0,02*	*PHI*	*-14,037*	*0,03*	*PHI*	*-14,037*	*0,04*	*PHI*	*-14,037*	*0,07*
Hourly Average Wages	**Estimate**	0,01	0,103**	-0,004	0,01	0,101**	-0,005	0,01	0,098**	-0,004	0,008	0,095**	-0,002	0,007	0,09**	-0,001
	Th. Variable/Th/p-val	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*
Non Manuf. ISM	**Estimate**	0,001	0,006	0,06**	0,001	0,005	0,062**	0,001	0,007	0,062**	0,001	0,007	0,062**	0,001	0,008	0,061**
	Th. Variable/Th/p-val	*FACT1*	*64,883*	*0*	*FACT1*	*64,883*	*0*	*FACT1*	*64,883*	*0*	*FACT1*	*64,883*	*0*	*FACT1*	*64,883*	*0*
Weekly Working Hours	**Estimate**	0,003	0,039**	-0,027	0,008	-0,017	0,049**	0,003	0,036**	-0,026	0,001	0,035**	-0,027	0,001	0,034**	-0,025
	Th. Variable/Th/p-val	*CONF*	*92,089*	*0*	*FACT2*	*-115,275*	*0*	*CONF*	*92,089*	*0*	*CONF*	*92,089*	*0*	*CONF*	*92,089*	*0,01*
Consumer Conf. Michigan	**Estimate**	-0,001	0,035**	0	-0,001	0,034**	0	0,001	0,036**	0	0,004	-0,007	0,025**	0,003	0,022**	-0,008
	Th. Variable/Th/p-val	*CONF*	*109,626*	*0,01*	*CONF*	*109,626*	*0,01*	*CONF*	*109,626*	*0,01*	*FACT2*	*-119,158*	*0,01*	*MICH*	*92,105*	*0,01*
GDP after 1999	**Estimate**	-0,008	-0,117	0,021**	-0,01	0,014*	0,079**	-0,009	0,014*	0,08**	-0,009	0,022**	-0,042	-0,008	0,02**	-0,039
	Th. Variable/Th/p-val	*MICH*	*108,021*	*0,05*	*PMI*	*43,968*	*0,06*	*PMI*	*43,968*	*0,06*	*MICH*	*84,147*	*0,06*	*MICH*	*84,147*	*0,07*
Weekly Jobless Claims	**Estimate**	0	0	0,016**	0	0,001	0,046**	0	0,002	0,047**	-0,001	0	0,016**	-0,001	0,001	0,042**
	Th. Variable/Th/p-val	*FACT1*	*81,692*	*0,03*	*PHI*	*-5,616*	*0,02*	*PHI*	*-5,616*	*0,02*	*FACT1*	*81,692*	*0,03*	*PHI*	*-5,616*	*0,02*
Building Permits	**Estimate**	-0,013	-0,002	0,101**	-0,011	-0,003	0,099**	-0,011	-0,003	0,093**	-0,012	-0,004	0,094**	-0,012	-0,002	0,091**
	Th. Variable/Th/p-val	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*
Empire Manufacturing	**Estimate**	0,011	-0,007	0,016	0,01	0,01	-0,086	0,005	-0,003	0,017	0,009	0,009	-0,085	0,002	-0,023	0,011
	Th. Variable/Th/p-val	*PMI*	*55,253*	*0,34*	*MICH*	*75,758*	*0,37*	*FACT1*	*98,877*	*0,39*	*MICH*	*75,758*	*0,38*	*PHI*	*33,216*	*0,39*
Personal Consumption	**Estimate**	-0,006	0,024**	-0,048	-0,005	0,025**	-0,04	-0,005	0,024**	-0,038	-0,003	0,024**	-0,048	0,002	0,033**	-0,013
	Th. Variable/Th/p-val	*FACT1*	*71,872*	*0,14*	*PHI*	*0,384*	*0,08*	*PHI*	*0,384*	*0,11*	*PHI*	*0,384*	*0,06*	*PMI*	*55,253*	*0,05*
Indice Help Wanted	**Estimate**	0,01	-0,017	0,035**	0,011	-0,018	0,037**	0,011	-0,021	0,038**	0,012	-0,017	0,041**	0,01	-0,017	0,04**
	Th. Variable/Th/p-val	*FED*	*3,395*	*0,01*	*FED*	*3,395*	*0*	*FED*	*3,053*	*0*	*FED*	*3,053*	*0,01*	*FED*	*3,053*	*0*
NAHB Housing Market Index	**Estimate**	-0,011	0,039**	-0,006	-0,012	0,036**	-0,007	-0,013	0,036**	-0,007	-0,012	0,036**	-0,006	-0,015	0,032**	-0,009
	Th. Variable/Th/p-val	*PHI*	*11,358*	*0,01*	*PHI*	*11,358*	*0,02*	*PHI*	*11,358*	*0,01*	*PHI*	*11,358*	*0,02*	*PHI*	*11,358*	*0,02*
Construction Spending	**Estimate**	0,012	0,019**	-0,053	0,014*	0,013	-0,051	0,014**	0,011	-0,05	0,016**	0,01	-0,049	0,017**	0,011	-0,048
	Th. Variable/Th/p-val	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*

Table 7: Results of the estimation of the threshold model, using the best performing threshold variable. * is for significative variable at 10% level and ** is for 5% level. (b)

		15 year			20 year			30 year		
		Intercept	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**	**Intercept**	**>Th**	**<Th**
Household consumption	**Estimate**	0,011**	-0,02	0,003	0,009	-0,026	0,003	0,011**	-0,021	0,007
	Th. Variable/Th/p-val	*FED*	*4,763*	*0,1*	*FED*	*4,763*	*0,05*	*FED*	*4,763*	*0,04*
Personal Income	**Estimate**	0,009*	0,037**	-0,001	0,006	0,035**	-0,001	0,008*	0,032**	-0,001
	Th. Variable/Th/p-val	*FACT1*	*94,128*	*0,01*	*FACT1*	*94,128*	*0,02*	*FACT1*	*94,128*	*0,03*
ISM manuf	**Estimate**	0,017**	0,116**	0,026**	0,014**	0,11**	0,024**	0,012**	0,094**	0,025**
	Th. Variable/Th/p-val	*FED*	*6,211*	*0*	*FED*	*6,211*	*0*	*FED*	*5,921*	*0*
Industrial New orders	**Estimate**	0,002	0,005	-0,091	0,003	0,051**	-0,003	0,004	0,06**	-0,003
	Th. Variable/Th/p-val	*CONF*	*78,937*	*0,01*	*FED*	*5,632*	*0,02*	*FED*	*5,632*	*0*
Construction Spending	**Estimate**	0,005	0,015	-0,138	0,004	0,017	-0,136	0	0,005	-0,106
	Th. Variable/Th/p-val	*FACT1*	*68,668*	*0,02*	*FACT1*	*68,668*	*0,01*	*FACT1*	*68,668*	*0,07*
Consumer Credit	**Estimate**	0,004	-0,112	0	0,003	-0,101	-0,002	0,002	-0,09	-0,002
	Th. Variable/Th/p-val	*PHI*	*27,879*	*0*	*PHI*	*27,879*	*0*	*PHI*	*27,879*	*0,01*
Wholesale Inventory	**Estimate**	-0,002	0,027**	-0,004	-0,002	0,027**	-0,004	-0,004	0,029**	-0,001
	Th. Variable/Th/p-val	*CONF*	*114,011*	*0,01*	*CONF*	*114,011*	*0,01*	*MICH*	*98,074*	*0*
Retail Sales	**Estimate**	0,003	0,019**	-0,02	0,002	0,016**	-0,02	0,002	0,017**	-0,019
	Th. Variable/Th/p-val	*MICH*	*80,168*	*0,05*	*MICH*	*80,168*	*0,06*	*MICH*	*80,168*	*0,03*
Industrial Production	**Estimate**	-0,008	0,008	0,056**	-0,007	0,008	0,063**	-0,008	0,005	0,052**
	Th. Variable/Th/p-val	*PHI*	*-14,037*	*0,01*	*PHI*	*-14,037*	*0,01*	*PHI*	*-14,037*	*0,01*
Housing Start	**Estimate**	-0,01	0	-0,004	-0,006	0	-0,006	-0,006	0	-0,006
	Th. Variable/Th/p-val	*PHI*	*-6,416*	*0,01*	*CONF*	*78,937*	*0*	*CONF*	*78,937*	*0*
Philifed Index	**Estimate**	-0,001	0,017**	0,523**	-0,002	0,017**	0,521**	-0,004	0,015**	0,475**
	Th. Variable/Th/p-val	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*
Existing Home Sales	**Estimate**	0,01**	0,001*	0,616**	0,009*	0,001*	0,606**	0,007*	0,001	0,589**
	Th. Variable/Th/p-val	*PMI*	*46,747*	*0,01*	*PMI*	*46,747*	*0,01*	*PMI*	*46,747*	*0,01*
Conf. Board Consumer Conf.	**Estimate**	0	0,003	0,056**	0,001	-0,002	0,038**	0,001	-0,002	0,039**
	Th. Variable/Th/p-val	*PMI*	*43,968*	*0*	*PHI*	*-6,416*	*0*	*PHI*	*-6,416*	*0*
GDP	**Estimate**	-0,003	-0,018	0,022*	-0,007	-0,023	0,022*	-0,008	-0,02	0,027**
	Th. Variable/Th/p-val	*FACT1*	*85,497*	*0,01*	*FACT1*	*85,497*	*0*	*FACT1*	*85,497*	*0*
Chicago PMI	**Estimate**	-0,019	0,004*	0,011**	-0,019	0,004	0,01**	-0,019	0,007**	-0,007
	Th. Variable/Th/p-val	*MICH*	*94,095*	*0,06*	*MICH*	*94,095*	*0,1*	*MICH*	*84,147*	*0,07*
New Home Sales	**Estimate**	-0,008	0,014**	-0,292	-0,007	0,015**	-0,253	-0,006	0,045**	0,008
	Th. Variable/Th/p-val	*PMI*	*41,053*	*0,02*	*PMI*	*41,053*	*0,03*	*MICH*	*102,053*	*0,01*
Consumer Price Index	**Estimate**	-0,011	0,033**	-0,001	-0,011	0,032**	-0,002	-0,011	0,027**	-0,003
	Th. Variable/Th/p-val	*MICH*	*98,074*	*0,01*	*MICH*	*98,074*	*0,01*	*MICH*	*98,074*	*0,01*
Unemployment Rate	**Estimate**	0,001	0,108**	-0,012	-0,001	0,106**	-0,009	-0,002	0,098**	-0,007
	Th. Variable/Th/p-val	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*	*PMI*	*60,642*	*0*
Trade Balance	**Estimate**	-0,006	0,042**	0,001	-0,008	0,04**	0	-0,004	0,04**	-0,002
	Th. Variable/Th/p-val	*FACT2*	*-109,378*	*0*	*FACT2*	*-109,378*	*0*	*FACT2*	*-109,378*	*0*
Jobless Claims	**Estimate**	0,001	-0,008	-0,073	0,001	-0,006	-0,068	0	-0,004	-0,045
	Th. Variable/Th/p-val	*PMI*	*41,189*	*0*	*PMI*	*41,189*	*0*	*PHI*	*-17,847*	*0*
Non Farm Payroll	**Estimate**	0,003	0,109**	0,021**	0	0,104**	0,019**	-0,001	0,095**	0,014*
	Th. Variable/Th/p-val	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*
Capacity Utilization Rate	**Estimate**	-0,01	0,01	6,187**	-0,007	0,01	7,052**	-0,013	0,01	5,43**
	Th. Variable/Th/p-val	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*	*FED*	*3,553*	*0*
Employment Cost Index	**Estimate**	0,009	0,024**	-0,075	-0,002	0,05**	0,011	-0,005	0,023*	-0,072
	Th. Variable/Th/p-val	*PHI*	*-12,274*	*0,17*	*FED*	*5,342*	*0,13*	*PHI*	*-12,274*	*0,18*
Wages	**Estimate**	-0,018	-0,001	0,037**	-0,02	-0,001	0,029**	-0,014	-0,001	0,014**
	Th. Variable/Th/p-val	*PHI*	*-15,374*	*0*	*PHI*	*-9,763*	*0*	*FACT1*	*65,128*	*0*
Productivity	**Estimate**	-0,002	-0,004	-0,081	-0,004	-0,012	0,037*	0,002	-0,006	-0,093
	Th. Variable/Th/p-val	*PHI*	*-14,037*	*0,04*	*MICH*	*82,158*	*0,03*	*PHI*	*-14,037*	*0,01*
Durable Good Orders	**Estimate**	0,001	0,003	-0,029	0,002	0,004	-0,027	0,004	0,008	-0,025
	Th. Variable/Th/p-val	*MICH*	*86,137*	*0,01*	*MICH*	*86,137*	*0,01*	*MICH*	*86,137*	*0*
Producer Price Index	**Estimate**	-0,004	0,001	-0,016	-0,006	-0,012	0	-0,007	-0,009	0,001
	Th. Variable/Th/p-val	*PHI*	*-14,037*	*0,07*	*FED*	*3,316*	*0,1*	*FED*	*3,316*	*0,12*
Hourly Average Wages	**Estimate**	0,006	0,084**	-0,003	0,004	0,08**	-0,003	0,001	0,074**	-0,003
	Th. Variable/Th/p-val	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*	*FACT1*	*97,784*	*0*
Non Manuf. ISM	**Estimate**	0,001	0,01	0,06**	0	0,013*	0,061**	0,002	0,009	0,049**
	Th. Variable/Th/p-val	*FACT1*	*64,883*	*0*	*PHI*	*-14,037*	*0,01*	*FACT1*	*64,883*	*0,01*
Weekly Working Hours	**Estimate**	0	0,029**	-0,018	-0,002	0,028**	-0,017	-0,005	0,022**	-0,014
	Th. Variable/Th/p-val	*CONF*	*92,089*	*0,01*	*CONF*	*92,089*	*0,01*	*CONF*	*92,089*	*0,04*
Consumer Conf. Michigan	**Estimate**	0	0,034**	0	0	0,02**	-0,009	-0,001	-0,009	0,019**
	Th. Variable/Th/p-val	*CONF*	*109,626*	*0,01*	*MICH*	*92,105*	*0,01*	*FACT2*	*-119,158*	*0,01*
GDP after 1999	**Estimate**	-0,007	0,02**	-0,036	-0,008	0,019**	-0,039	-0,011	0,016**	-0,043
	Th. Variable/Th/p-val	*MICH*	*84,147*	*0,08*	*MICH*	*84,147*	*0,07*	*MICH*	*84,147*	*0,06*
Weekly Jobless Claims	**Estimate**	-0,001	0,001	0,043**	0	0,001	0,048**	0	0,001	0,041**
	Th. Variable/Th/p-val	*PHI*	*-5,616*	*0,02*	*PHI*	*-5,616*	*0,01*	*PHI*	*-5,616*	*0,01*
Building Permits	**Estimate**	-0,013	-0,002	0,088**	-0,012	-0,001	0,09**	-0,01	0	0,089**
	Th. Variable/Th/p-val	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*	*PMI*	*51,968*	*0*
Empire Manufacturing	**Estimate**	-0,002	0,005	0,044*	-0,004	0,003	0,046*	-0,003	-0,009	0,014
	Th. Variable/Th/p-val	*FED*	*1,184*	*0,15*	*FED*	*1,184*	*0,11*	*PMI*	*55,253*	*0,28*
Personal Consumption	**Estimate**	-0,002	0,022*	-0,046	0	0,02*	-0,076	-0,003	0,019*	-0,088
	Th. Variable/Th/p-val	*PHI*	*0,384*	*0,07*	*FACT1*	*71,872*	*0,04*	*FACT1*	*71,872*	*0,02*
Indice Help Wanted	**Estimate**	0,01	-0,016	0,04**	0,009	-0,017	0,041**	0,004	0,006	0,07**
	Th. Variable/Th/p-val	*FED*	*3,053*	*0,01*	*FED*	*3,053*	*0*	*PMI*	*51,968*	*0*
NAHB Housing Market Index	**Estimate**	-0,017	0,03**	-0,017	-0,018	0,033**	-0,018	-0,016	0,03**	-0,019
	Th. Variable/Th/p-val	*PHI*	*11,358*	*0,01*	*PHI*	*11,358*	*0*	*PHI*	*11,358*	*0*
Construction Spending	**Estimate**	0,016**	0,006	-0,046	0,016**	0,004	-0,044	0,017**	0,005	-0,041
	Th. Variable/Th/p-val	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*	*PHI*	*1,868*	*0*

Table 8: Results of the estimation of the threshold model, using the best performing threshold variable. * is for significative variable at 10% level and ** is for 5% level. (c)

Rank	1 year	2 year	3 year	4 year	5 year	6 year	7 year
1	Wholesale Inventory	Non Farm Payroll	Non Farm Payroll	Non Farm Payroll	Non Farm Payroll	Non Farm Payroll	Non Farm Payroll
2	Philifed Index	ISM manuf	ISM manuf	ISM manuf	ISM manuf	ISM manuf	ISM manuf
3	Non Farm Payroll	Employment Cost Index	Employment Cost Index	Employment Cost Index	Employment Cost Index	Employment Cost Index	Employment Cost Index
4	ISM manuf	Philifed Index	Philifed Index	Philifed Index	Philifed Index	Philifed Index	Philifed Index
5	Industrial Production	Durable Good Orders	Personal Consumption	GDP after 1999	Personal Consumption	Personal Consumption	Non Manuf. ISM
6	GDP after 1999	NAHB Housing Market Index	Non Manuf. ISM	NAHB Housing Market Index	GDP after 1999	GDP after 1999	GDP after 1999
7	GDP	Unemployment Rate	Durable Good Orders	Non Manuf. ISM	Non Manuf. ISM	Non Manuf. ISM	Indice Help Wanted
8	Construction Spending	Conf. Board Consumer Conf.	Conf. Board Consumer Conf.	Jobless Claims	Retail Sales	Retail Sales	Retail Sales
9	Jobless Claims	Jobless Claims	Retail Sales	Durable Good Orders	Industrial Production	Industrial Production	Industrial Production
10	NAHB Housing Market Index	Industrial Production	GDP after 1999	Retail Sales	Conf. Board Consumer Conf.	NAHB Housing Market Index	Conf. Board Consumer Conf.
11	Chicago PMI	Non Manuf. ISM	Jobless Claims	Industrial Production	Jobless Claims	Indice Help Wanted	New Home Sales
12		New Home Sales	Industrial Production	New Home Sales	New Home Sales	New Home Sales	Jobless Claims
13		Chicago PMI	Trade Balance	Conf. Board Consumer Conf.	Durable Good Orders	Consumer Price Index	Chicago PMI
14			New Home Sales	Chicago PMI	Chicago PMI	Jobless Claims	
15			Chicago PMI			Conf. Board Consumer Conf.	
16			Existing Home Sales			Wholesale Inventory	
17						Chicago PMI	
Rank	**8 year**	**9 year**	**10 year**	**15 year**	**20 year**	**30 year**	
1	Non Farm Payroll	Non Farm Payroll	Non Farm Payroll	Non Farm Payroll	Non Farm Payroll	Non Farm Payroll	
2	ISM manuf	ISM manuf	ISM manuf	ISM manuf	ISM manuf	ISM manuf	
3	Employment Cost Index	Employment Cost Index	Employment Cost Index	Non Manuf. ISM	Employment Cost Index	Employment Cost Index	
4	Philifed Index	Philifed Index	Non Manuf. ISM	Employment Cost Index	Non Manuf. ISM	Non Manuf. ISM	
5	Non Manuf. ISM	Non Manuf. ISM	Indice Help Wanted	Philifed Index	Indice Help Wanted	Indice Help Wanted	
6	GDP after 1999	Indice Help Wanted	Industrial Production	Indice Help Wanted	Philifed Index	Wholesale Inventory	
7	Industrial Production	Industrial Production	Philifed Index	GDP after 1999	GDP after 1999	Philifed Index	
8	Retail Sales	GDP after 1999	GDP after 1999	Industrial Production	Industrial Production	New Home Sales	
9	NAHB Housing Market Index	NAHB Housing Market Index	Retail Sales	New Home Sales	New Home Sales	Retail Sales	
10	Conf. Board Consumer Conf.	Wholesale Inventory	Conf. Board Consumer Conf.	Wholesale Inventory	Wholesale Inventory	Industrial Production	
11	New Home Sales	Retail Sales	New Home Sales	Trade Balance	Trade Balance	Jobless Claims	
12	Jobless Claims	Conf. Board Consumer Conf.	Trade Balance	Retail Sales	Jobless Claims	Chicago PMI	
13	Chicago PMI	New Home Sales	Jobless Claims	Jobless Claims	Chicago PMI		
14		Jobless Claims	Chicago PMI	Conf. Board Consumer Conf.	Existing Home Sales		
15		Consumer Price Index	Existing Home Sales	Chicago PMI			
16		Chicago PMI		Existing Home Sales			
17							

Table 9: List of the ranked market mover announcements found using model 1

	1 year		2 year		3 year		4 year	
Rank	**Variable**	**Condition**	**Variable**	**Condition**	**Variable**	**Condition**	**Variable**	**Condition**
1	Capacity Utilization Rate	FED < 5,447	Capacity Utilization Rate	FED < 3,553	Capacity Utilization Rate	FED < 3,553	Capacity Utilization Rate	FED < 3,553
2	Existing Home Sales	FACT1 < 53,916	Trade Balance	PHI < -26,126	Trade Balance	PHI < -26,126	Philifed Index	PMI < 41,189
3	Trade Balance	PHI < -26,126	Philifed Index	PMI < 41,189	Philifed Index	PMI < 41,189	Consumer Price Index	CONF < 78,937
4	Construction Spending	PMI < 43,758	Existing Home Sales	PMI < 49,526	Existing Home Sales	PMI < 49,526	Unemployment Rate	PMI > 60,642
5	Construction Spending	PMI < 53,737	Industrial New orders	PHI < -14,037	Consumer Price Index	CONF < 78,937	Non Farm Payroll	FACT1 > 97,784
6	GDP after 1999	PMI < 45,358	Consumer Price Index	CONF < 78,937	Unemployment Rate	PMI > 60,642	ISM manuf	FED > 6,211
7	Personal Income	MICH > 108,305	Non Farm Payroll	FACT1 > 97,784	Non Farm Payroll	FACT1 > 97,784	Hourly Average Wages	FACT1 > 97,784
8	ISM manuf	FED > 6,211	Unemployment Rate	PMI > 60,642	Hourly Average Wages	FACT1 > 97,784	Building Permits	PMI < 51,968
9	Personal Consumption	MICH > 96,011	ISM manuf	FED > 6,211	Building Permits	PMI < 51,968	Wholesale Inventory	PHI < -10,226
10	Wholesale Inventory	PMI < 50,916	Retail Sales	FED > 6,211	Personal Consumption	MICH > 96,011	Industrial Production	PHI < -14,037
11	Conf. Board Consumer Conf.	FED > 6,211	Hourly Average Wages	FACT1 > 97,784	Industrial Production	PHI < -14,037	Non Manuf. ISM	FACT1 < 64,883
12	Weekly Working Hours	PHI > 27,879	Industrial Production	PHI < -14,037	Non Manuf. ISM	PHI < -14,037	Employment Cost Index	CONF > 108,353
13	Indice Help Wanted	CONF < 77,905	Building Permits	PMI < 51,968	ISM manuf	MICH > 86,137	Personal Income	FACT1 > 94,128
14	Non Manuf. ISM	PMI < 45,358	Personal Consumption	MICH > 96,011	Employment Cost Index	CONF > 108,353	Consumer Conf. Michigan	FACT1 < 61,227
15	Non Farm Payroll	MICH < 98,074	Non Manuf. ISM	PHI < -14,037	NAHB Housing Market Index	FACT2 > -101,575	NAHB Housing Market Index	PHI > 11,358
16	Industrial Production	CONF < 140,316	Construction Spending	MICH < 104,758	Personal Income	FACT1 > 94,128	Existing Home Sales	MICH < 100,063
17	Philifed Index	PMI > 42,579	Employment Cost Index	FACT1 > 86,592	Wholesale Inventory	PHI < -10,226	Conf. Board Consumer Conf.	FED > 3,605
18	Consumer Price Index	MICH > 98,074	NAHB Housing Market Index	FACT2 > -101,575	Weekly Working Hours	FACT2 < -115,275	Trade Balance	FACT2 > -112,93
19	Consumer Conf. Michigan	CONF > 109,626	Wholesale Inventory	PHI < -10,226	Consumer Conf. Michigan	FACT1 < 61,227	Weekly Working Hours	CONF > 92,089
20	NAHB Housing Market Index	FACT2 > -101,575	Weekly Working Hours	FACT2 < -115,275	Conf. Board Consumer Conf.	FED > 3,605	Indice Help Wanted	FED < 3,395
21	Industrial New orders	PMI > 43,832	Conf. Board Consumer Conf.	FED > 3,605	GDP	FACT1 < 85,497	Retail Sales	MICH > 80,168
22	Retail Sales	MICH < 110,011	GDP	FACT1 < 85,497	Indice Help Wanted	FED < 3,395	GDP	FACT1 < 85,497
23	Employment Cost Index	PHI < 6,221	Productivity	PMI > 58,589	Retail Sales	MICH > 84,147	Personal Consumption	PHI > 6,968
24	Durable Good Orders	FACT1 > 81,258	Consumer Conf. Michigan	MICH > 92,105	Empire Manufacturing	PMI < 55,253	Chicago PMI	MICH < 94,095
25			Empire Manufacturing	PMI < 55,253	Chicago PMI	MICH < 94,095	New Home Sales	PHI > -21,658
26			Indice Help Wanted	FED < 3,395	New Home Sales	PHI > -21,658	Wages	FACT1 < 65,128
27			Chicago PMI	MICH < 94,095	GDP after 1999	MICH < 108,021	GDP after 1999	MICH < 108,021
28			New Home Sales	PHI > -21,658	Weekly Jobless Claims	FACT1 < 81,692	Weekly Jobless Claims	FACT1 < 81,692
29			GDP after 1999	MICH < 108,021	Construction Spending	PHI > 1,868	Construction Spending	PHI > 1,868
30			Weekly Jobless Claims	FACT1 < 81,692				
31			Construction Spending	PHI > 1,868				

	5 year		6 year		7 year		8 year	
Rank	**Variable**	**Condition**	**Variable**	**Condition**	**Variable**	**Condition**	**Variable**	**Condition**
1	Capacity Utilization Rate	FED < 3,553	Capacity Utilization Rate	FED < 3,553	Capacity Utilization Rate	FED < 3,553	Capacity Utilization Rate	FED < 3,553
2	Philifed Index	PMI < 41,189	Existing Home Sales	PMI < 46,747	Existing Home Sales	PMI < 46,747	Existing Home Sales	PMI < 46,747
3	Unemployment Rate	PMI > 60,642	Philifed Index	PMI < 41,189	Philifed Index	PMI < 41,189	Philifed Index	PMI < 41,189
4	Consumer Price Index	CONF < 78,937	Consumer Price Index	CONF < 78,937	Consumer Price Index	CONF < 78,937	Unemployment Rate	PMI > 60,642
5	Non Farm Payroll	FACT1 > 97,784	Unemployment Rate	PMI > 60,642	Unemployment Rate	PMI > 60,642	Consumer Price Index	CONF < 78,937
6	Hourly Average Wages	FACT1 > 97,784	Non Farm Payroll	FACT1 > 97,784	Non Farm Payroll	FACT1 > 97,784	Non Farm Payroll	FACT1 > 97,784
7	Building Permits	PMI < 51,968	ISM manuf	FED > 6,211	ISM manuf	FED > 6,211	ISM manuf	FED > 6,211
8	GDP after 1999	PMI < 43,968	Hourly Average Wages	FACT1 > 97,784	Hourly Average Wages	FACT1 > 97,784	Hourly Average Wages	FACT1 > 97,784
9	Industrial Production	PHI < -14,037	Building Permits	PMI < 51,968	Building Permits	PMI < 51,968	Building Permits	PMI < 51,968
10	Employment Cost Index	FED > 5,342	Retail Sales	FED > 6,211	GDP after 1999	PMI < 43,968	GDP after 1999	PMI < 43,968
11	Wholesale Inventory	PHI < -10,226	Employment Cost Index	FED > 5,342	Industrial Production	PHI < -14,037	Industrial Production	PHI < -14,037
12	Non Manuf. ISM	FACT1 < 64,883	Industrial Production	PHI < -14,037	Employment Cost Index	FED > 5,342	Employment Cost Index	FED > 5,342
13	Existing Home Sales	MICH < 100,063	Non Manuf. ISM	FACT1 < 64,883	Non Manuf. ISM	FACT1 < 64,883	Non Manuf. ISM	FACT1 < 64,883
14	Consumer Conf. Michigan	FACT1 < 61,227	Personal Income	FACT1 > 94,128	Personal Income	FACT1 > 94,128	Personal Income	FACT1 > 94,128
15	Personal Income	FACT1 > 94,128	Conf. Board Consumer Conf.	PMI < 49,526	Weekly Working Hours	FACT2 < -115,275	New Home Sales	MICH > 102,053
16	ISM manuf	MICH > 86,137	Trade Balance	FACT2 > -109,378	Weekly Jobless Claims	PHI < -5,616	Trade Balance	FACT2 > -109,378
17	GDP	FACT1 < 85,497	Weekly Working Hours	CONF > 92,089	Conf. Board Consumer Conf.	PMI < 49,526	Weekly Jobless Claims	PHI < -5,616
18	NAHB Housing Market Index	PHI > 11,358	Consumer Conf. Michigan	CONF > 109,626	GDP	FACT1 < 85,497	Conf. Board Consumer Conf.	PMI < 49,526
19	Conf. Board Consumer Conf.	PMI < 49,526	Indice Help Wanted	FED < 3,395	Trade Balance	FACT2 > -109,378	Weekly Working Hours	CONF > 92,089
20	Trade Balance	FACT2 > -112,93	NAHB Housing Market Index	PHI > 11,358	Consumer Conf. Michigan	CONF > 109,626	Consumer Conf. Michigan	CONF > 109,626
21	Weekly Working Hours	CONF > 92,089	GDP	FACT1 < 85,497	Indice Help Wanted	FED < 3,395	Indice Help Wanted	FED < 3,053
22	Indice Help Wanted	FED < 3,395	GDP after 1999	MICH < 108,021	NAHB Housing Market Index	PHI > 11,358	NAHB Housing Market Index	PHI > 11,358
23	Retail Sales	MICH > 80,168	Personal Consumption	FACT1 > 71,872	Retail Sales	MICH > 88,126	Wholesale Inventory	FACT2 < -134,687
24	Personal Consumption	FACT1 > 71,872	Wholesale Inventory	PMI > 41,189	Personal Consumption	PHI > 0,384	Retail Sales	MICH > 80,168
25	Chicago PMI	MICH < 94,095	Chicago PMI	MICH < 94,095	Chicago PMI	MICH < 94,095	Personal Consumption	PHI > 0,384
26	New Home Sales	PMI > 41,053	New Home Sales	PHI > -21,658	New Home Sales	PHI > -21,658	Chicago PMI	MICH < 94,095
27	Wages	FACT1 < 65,128	Wages	FACT1 < 65,128	Wages	FACT1 < 65,128	Wages	FACT1 < 65,128
28	Weekly Jobless Claims	FACT1 < 81,692	Weekly Jobless Claims	FACT1 < 81,692				
29	Construction Spending	PHI > 1,868	Construction Spending	PHI > 1,868				
30								
31								

Table 10: List of the ranked market movers announcements found when estimating model 2 for each available maturity, along with the threshold variable used for the estimation and the value of the threshold. (a)

	9 year		10 year		15 year	
Rank	**Variable**	**Condition**	**Variable**	**Condition**	**Variable**	**Condition**
1	Capacity Utilization Rate	FED<3,553	Capacity Utilization Rate	FED<3,553	Capacity Utilization Rate	FED<3,553
2	Existing Home Sales	PMI<46,747	Philifed Index	PMI<41,189	Existing Home Sales	PMI<46,747
3	Philifed Index	PMI<41,189	Unemployment Rate	PMI>60,642	Philifed Index	PMI<41,189
4	Unemployment Rate	PMI>60,642	ISM manuf	FED>6,211	ISM manuf	FED>6,211
5	Non Farm Payroll	FACT1>97,784	Non Farm Payroll	FACT1>97,784	Unemployment Rate	PMI>60,642
6	ISM manuf	FED>6,211	Consumer Price Index	CONF<78,937	Non Farm Payroll	FACT1>97,784
7	Hourly Average Wages	FACT1>97,784	Hourly Average Wages	FACT1>97,784	Hourly Average Wages	FACT1>97,784
8	Building Permits	PMI<51,968	Building Permits	PMI<51,968	Building Permits	PMI<51,968
9	Employment Cost Index	FED>5,342	Conf. Board Consumer Conf.	PMI<43,968	Non Manuf. ISM	FACT1<64,883
10	Non Manuf. ISM	FACT1<64,883	Non Manuf. ISM	FACT1<64,883	Industrial Production	PHI<-14,037
11	New Home Sales	MICH>102,053	Wholesale Inventory	PHI<-10,226	Conf. Board Consumer Conf.	PMI<43,968
12	Personal Income	FACT1>94,128	Retail Sales	CONF>122,779	Trade Balance	FACT2>-109,378
13	Retail Sales	CONF>122,779	Existing Home Sales	MICH<100,063	Weekly Jobless Claims	PHI<-5,616
14	Trade Balance	FACT2>-109,378	New Home Sales	MICH>102,053	Empire Manufacturing	FED<1,184
15	Indice Help Wanted	FED<3,053	Employment Cost Index	FED>5,342	Indice Help Wanted	FED<3,053
16	Wholesale Inventory	CONF>114,011	Personal Income	FACT1>94,128	Personal Income	FACT1>94,128
17	Conf. Board Consumer Conf.	PMI<49,526	Trade Balance	FACT2>-109,378	Consumer Price Index	MICH>98,074
18	Consumer Price Index	MICH>98,074	Weekly Jobless Claims	PHI<-5,616	Wages	PHI<-15,374
19	Weekly Working Hours	CONF>92,089	Indice Help Wanted	FED<3,053	Consumer Conf. Michigan	CONF>109,626
20	NAHB Housing Market Index	PHI>11,358	Weekly Working Hours	CONF>92,089	NAHB Housing Market Index	PHI>11,358
21	Industrial Production	PMI<56,474	Personal Consumption	PMI>55,253	Wholesale Inventory	CONF>114,011
22	Consumer Conf. Michigan	FACT2<-119,158	NAHB Housing Market Index	PHI>11,358	GDP	FACT1<85,497
23	GDP after 1999	MICH>84,147	Industrial Production	PMI<56,474	Employment Cost Index	PHI>-12,274
24	Personal Consumption	PHI>0,384	Consumer Conf. Michigan	MICH>92,105	Weekly Working Hours	CONF>92,089
25	Chicago PMI	MICH<94,095	GDP after 1999	MICH>84,147	GDP after 1999	MICH>84,147
26	Wages	FACT1<65,128	Chicago PMI	MICH<94,095	Personal Consumption	PHI>0,384
27	Weekly Jobless Claims	FACT1<81,692	Wages	FACT1<65,128	Retail Sales	MICH>80,168
28					Chicago PMI	MICH<94,095
29					New Home Sales	PMI>41,053
30						
31						

	20 year		30 year	
Rank	**Variable**	**Condition**	**Variable**	**Condition**
1	Capacity Utilization Rate	FED<3,553	Capacity Utilization Rate	FED<3,553
2	Existing Home Sales	PMI<46,747	Existing Home Sales	PMI<46,747
3	Philifed Index	PMI<41,189	Philifed Index	PMI<41,189
4	ISM manuf	FED>6,211	ISM manuf	FED>5,921
5	Unemployment Rate	PMI>60,642	Unemployment Rate	PMI>60,642
6	Non Farm Payroll	FACT1>97,784	Non Farm Payroll	FACT1>97,784
7	Building Permits	PMI<51,968	Building Permits	PMI<51,968
8	Hourly Average Wages	FACT1>97,784	Hourly Average Wages	FACT1>97,784
9	Industrial Production	PHI<-14,037	Indice Help Wanted	PMI<51,968
10	Non Manuf. ISM	PHI<-14,037	Industrial New orders	FED>5,632
11	Industrial New orders	FED>5,632	Industrial Production	PHI<-14,037
12	Employment Cost Index	FED>5,342	New Home Sales	MICH>102,053
13	Trade Balance	FACT2>-109,378	Trade Balance	FACT2>-109,378
14	Weekly Jobless Claims	PHI<-5,616	Non Manuf. ISM	FACT1<64,883
15	Empire Manufacturing	FED<1,184	Weekly Jobless Claims	PHI<-5,616
16	Indice Help Wanted	FED<3,053	Personal Income	FACT1>94,128
17	Personal Income	FACT1>94,128	Conf. Board Consumer Conf.	PHI<-6,416
18	Conf. Board Consumer Conf.	PHI<-6,416	NAHB Housing Market Index	PHI>11,358
19	Consumer Price Index	MICH>98,074	Wholesale Inventory	MICH>98,074
20	Productivity	MICH<82,158	GDP	FACT1<85,497
21	NAHB Housing Market Index	PHI>11,358	Consumer Price Index	MICH>98,074
22	Wholesale Inventory	CONF>114,011	Employment Cost Index	PHI>-12,274
23	GDP	FACT1<85,497	Weekly Working Hours	CONF>92,089
24	Wages	PHI<-9,763	Retail Sales	MICH>80,168
25	Weekly Working Hours	CONF>92,089	Wages	FACT1<65,128
26	Consumer Conf. Michigan	MICH>92,105	Consumer Conf. Michigan	FACT2<-119,158
27	Personal Consumption	FACT1>71,872	GDP after 1999	MICH>84,147
28	Retail Sales	MICH>80,168	Personal Consumption	FACT1>71,872
29	Chicago PMI	MICH<94,095		
30	New Home Sales	PMI>41,053		
31	GDP after 1999	MICH>84,147		

Table 11: List of the ranked market movers announcements found when estimating model 2 for each available maturity, along with the threshold variable used for the estimation and the value of the threshold. (b)

	1 year		2 year		3 year		4 year		5 year	
	Intercept 1	Intercept 2	Intercept 1	Intercept 2	Intercept 1	Intercept 2	Intercept 1	Intercept 2	Intercept 1	Intercept 2
Household consumption	-0,015**	-0,013	0,009*	0,008(+)	0,013**	0,013**(+)	0,01*	0,01*	0,008	0,007(+)
Personal Income	-0,016**	-0,017(+)	0,009*	0,009*(+)	0,013**	0,012**(+)	0,01*	0,01*(+)	0,007	0,007(+)
ISM manuf	-0,017**	-0,013(+)	0,006	0,011**(+)	0,009	0,009(+)	0,007	0,013**(+)	0,009	0,008(+)
Industrial New orders	-0,024**	-0,024(+)	-0,002	-0,001(+)	0	-0,001(+)	0	-0,001(+)	0	-0,001(+)
Construction Spending	-0,031**	-0,032(+)	0	0(+)	0,001	0(+)	0	-0,001(+)	0,001	0,004(+)
Consumer Credit	-0,02**	-0,018(+)	0,004	0,005(+)	0	0,001(+)	-0,001	0(+)	0,002	0,003(+)
Wholesale Inventory	-0,02**	-0,014(+)	-0,001	0,001(+)	-0,001	0,001(+)	-0,003	0(+)	-0,002	0(+)
Retail Sales	-0,007	-0,01(+)	0,001	-0,001(+)	0,002	0,001(+)	0,001	0,002(+)	0,002	0,003(+)
Industrial Production	-0,023**	-0,019(+)	-0,002	-0,002(+)	-0,004	-0,004(+)	-0,006	-0,006(+)	-0,005	-0,004(+)
Housing Start	-0,019**	-0,016(+)	-0,004	-0,001(+)	-0,008	-0,007(+)	-0,009	-0,008(+)	-0,007	-0,005(+)
Philifed Index	-0,013**	-0,01(+)	0,004	0,001(+)	0,007	0,004(+)	0,007	0,004(+)	0,006	0,003(+)
Existing Home Sales	-0,005	-0,006(+)	0,007	0,006(+)	0,008	0,007(+)	0,009	0,007(+)	0,008	0,006(+)
Conf. Board Consumer Conf.	-0,012**	-0,01(+)	-0,013**	-0,015(+)	-0,009	-0,012(+)	-0,008	-0,01(+)	-0,008	-0,006(+)
GDP	-0,006	-0,01(+)	0,004	-0,001(+)	-0,001	-0,006(+)	0,001	-0,004(+)	0,004	-0,001(+)
Chicago PMI	-0,021**	-0,022(+)	-0,024**	-0,023(+)	-0,027**	-0,026(+)	-0,026**	-0,026(+)	-0,026**	-0,025(+)
New Home Sales	-0,016**	-0,015(+)	-0,012*	-0,011(+)	-0,013**	-0,012(+)	-0,01	-0,009(+)	-0,008	-0,006(+)
Consumer Price Index	-0,018**	-0,018(+)	-0,004	-0,005(+)	-0,005	-0,006(+)	-0,007	-0,009(+)	-0,004	-0,005(+)
Unemployment Rate	-0,021**	-0,024(+)	-0,007	-0,003(+)	-0,004	0,001(+)	-0,005	0(+)	0	0,004(+)
Trade Balance	-0,011*	-0,01(+)	-0,005	-0,002(+)	-0,006	-0,003(+)	-0,003	-0,003(+)	-0,004	-0,004(+)
Jobless Claims	-0,011**	-0,011(+)	0,001	0(+)	0	-0,001(+)	0	0(+)	0	0(+)
Non Farm Payroll	-0,018**	-0,016(+)	0,006	0,003(+)	0,009	0,006(+)	0,008	0,004(+)	0,011	0,008(+)
Capacity Utilization Rate	-0,053**	-0,052(+)	-0,011	-0,008(+)	-0,012	-0,01(+)	-0,015*	-0,012(+)	-0,014	-0,011(+)
Employment Cost Index	-0,005	-0,006(+)	0,001	-0,001(+)	0,004	0,004(+)	0,006	0,007(+)	0,003	0,002(+)
Wages	-0,04**	-0,043(+)	-0,008	-0,005(+)	-0,011	-0,011(+)	-0,013	-0,013(+)	-0,009	-0,009(+)
Productivity	-0,007	-0,005(+)	0	-0,001(+)	-0,002	-0,001(+)	-0,006	-0,007(+)	-0,006	-0,007(+)
Durable Good Orders	-0,004	0(+)	0,001	0,004(+)	-0,005	-0,008(+)	-0,004	-0,006(+)	-0,002	-0,004(+)
Producer Price Index	-0,008*	-0,008(+)	0	-0,001(+)	-0,003	-0,004(+)	-0,004	-0,005(+)	-0,006	-0,007(+)
Hourly Average Wages	-0,019**	-0,016(+)	-0,001	0,005(+)	0,002	0,008(+)	-0,001	0,006(+)	0,003	0,01(+)
Non Manuf. ISM	-0,004	0,001(+)	-0,01	-0,006(+)	-0,007	-0,004(+)	-0,007	-0,002(+)	-0,004	0,001(+)
Weekly Working Hours	-0,007	-0,006(+)	0	0,001(+)	0,003	0,005(+)	0	-0,002(+)	0,004	0,002(+)
Consumer Conf. Michigan	0	0(+)	0,001	0,003(+)	0,003	0,001(+)	-0,001	-0,002(+)	0	-0,002(+)
GDP after 1999	-0,006	-0,005(+)	-0,013*	-0,009(+)	-0,011	-0,007(+)	-0,011	-0,007(+)	-0,01	-0,01(+)
Weekly Jobless Claims	0,006**	0,006**	0,002	0,002	0,002	0,002	0,002	0,002(+)	0,001	0,001(+)
Building Permits	0,013**	0,012**(+)	-0,004	-0,004(+)	-0,009	-0,009(+)	-0,007	-0,006(+)	-0,01	-0,009(+)
Empire Manufacturing	0,011**	0,009**(+)	0,011	0,011(+)	0,013	0,014(+)	0,011	0,011	0,017	0,019
Personal Consumption	0,01	0,011*(+)	-0,011	-0,01	-0,008	-0,007	-0,007	-0,005	-0,008	-0,006
Indice Help Wanted	0,013**	0,016**(+)	-0,001	0,004(+)	0,003	0,009(+)	0,005	0,011(+)	0,003	0,01(+)
NAHB Housing Market Index	0,01**	0,011**(+)	-0,003	-0,001(+)	-0,001	0,002(+)	-0,008	-0,008(+)	-0,01	-0,01(+)
Construction Spending	0,003	0,007*(+)	0,01	0,006(+)	0,017	0,012(+)	0,014	0,01(+)	0,017*	0,013(+)

	6 year		7 year		8 year		9 year		10 year	
	Intercept 1	Intercept 2	Intercept 1	Intercept 2	Intercept 1	Intercept 2	Intercept 1	Intercept 2	Intercept 1	Intercept 2
Household consumption	0,012**	0,011**	0,011*	0,011*	0,013**	0,015**(+)	0,013**	0,015**	0,01*	0,012**
Personal Income	0,011**	0,011**(+)	0,01*	0,01*(+)	0,013**	0,012**(+)	0,013**	0,013**(+)	0,01*	0,009*(+)
ISM manuf	0,011*	0,016**(+)	0,01	0,016**(+)	0,011*	0,016**(+)	0,011*	0,016**(+)	0,012*	0,018**(+)
Industrial New orders	0,003	0,002(+)	0,001	0(+)	0,004	0,003(+)	0,003	0,001(+)	-0,001	-0,002(+)
Construction Spending	0,003	0,006(+)	0,002	0,005(+)	0,001	0,004(+)	0,003	0,006(+)	0,003	0,005(+)
Consumer Credit	0,001	0,004(+)	-0,002	-0,001(+)	0,004	0,004(+)	-0,001	-0,001(+)	0	0(+)
Wholesale Inventory	-0,002	0(+)	-0,005	-0,004(+)	0	-0,002(+)	-0,003	-0,005(+)	-0,001	0,002(+)
Retail Sales	0,003	0,002(+)	0,002	0,001(+)	0,003	0,004(+)	0,004	0,004(+)	0	0(+)
Industrial Production	-0,003	-0,003(+)	-0,006	-0,006(+)	-0,005	-0,004(+)	-0,006	-0,007(+)	-0,009	-0,011(+)
Housing Start	-0,009	-0,005(+)	-0,008	-0,007(+)	-0,009	-0,008(+)	-0,01	-0,009(+)	-0,01	-0,009(+)
Philifed Index	0,004	0,001(+)	0,002	-0,001(+)	0,002	-0,001(+)	0,003	0(+)	-0,001	-0,004(+)
Existing Home Sales	0,016*	0,015*(+)	0,015*	0,014*(+)	0,019**	0,018**(+)	0,017*	0,016*(+)	0,007	0,005(+)
Conf. Board Consumer Conf.	-0,008	-0,006(+)	-0,005	-0,003(+)	-0,006	-0,004(+)	-0,007	-0,004(+)	-0,006	-0,005(+)
GDP	0,002	-0,002(+)	-0,005	-0,01(+)	-0,001	-0,004(+)	-0,001	-0,005(+)	-0,014	-0,018(+)
Chicago PMI	-0,027**	-0,026(+)	-0,027**	-0,026(+)	-0,023**	-0,023(+)	-0,024**	-0,023(+)	-0,027**	-0,027(+)
New Home Sales	-0,008	-0,007(+)	-0,008	-0,007(+)	-0,006	-0,007(+)	-0,007	-0,007(+)	-0,009	-0,009(+)
Consumer Price Index	-0,007	-0,008(+)	-0,007	-0,009(+)	-0,006	-0,007(+)	-0,006	-0,006(+)	-0,01	-0,011(+)
Unemployment Rate	-0,002	0,003(+)	-0,001	0,003(+)	0,001	0,005(+)	-0,004	0(+)	-0,003	0,001(+)
Trade Balance	-0,006	-0,005(+)	-0,004	-0,003(+)	-0,007	-0,006(+)	-0,007	-0,006(+)	-0,011*	-0,01(+)
Jobless Claims	0,001	0(+)	-0,001	-0,002(+)	0	0(+)	0	0(+)	-0,003	-0,003(+)
Non Farm Payroll	0,01	0,007(+)	0,009	0,006(+)	0,012	0,009(+)	0,006	0,003(+)	0,006	0,003(+)
Capacity Utilization Rate	-0,009	-0,006(+)	-0,014	-0,012(+)	-0,011	-0,008(+)	-0,014	-0,011(+)	-0,02**	-0,018(+)
Employment Cost Index	0,003	0,002(+)	0	0(+)	-0,001	-0,001(+)	-0,002	-0,003(+)	-0,004	-0,004(+)
Wages	-0,009	-0,009(+)	-0,011	-0,012(+)	-0,006	-0,006(+)	-0,008	-0,008(+)	-0,013	-0,013(+)
Productivity	-0,005	-0,004(+)	-0,005	-0,005(+)	-0,004	-0,003(+)	-0,005	-0,004(+)	-0,008	-0,007(+)
Durable Good Orders	0	-0,002(+)	0,001	-0,001(+)	-0,001	0,001(+)	0	-0,002(+)	-0,002	-0,004(+)
Producer Price Index	-0,006	-0,007(+)	-0,005	-0,006(+)	-0,005	-0,006(+)	-0,005	-0,006(+)	-0,008	-0,009(+)
Hourly Average Wages	0,003	0,01(+)	0,004	0,01(+)	0,003	0,01(+)	0,001	0,008(+)	0,001	0,007(+)
Non Manuf. ISM	-0,004	0,001(+)	-0,003	0,001(+)	-0,004	0,001(+)	-0,004	0,001(+)	-0,004	0,001(+)
Weekly Working Hours	0,005	0,003(+)	0,006	0,008(+)	0,005	0,003(+)	0,003	0,001(+)	0,003	0,001(+)
Consumer Conf. Michigan	-0,001	-0,001(+)	-0,001	-0,001(+)	0,001	0,001(+)	0,002	0,004(+)	0	0,003(+)
GDP after 1999	-0,011	-0,008(+)	-0,01	-0,01(+)	-0,009	-0,009(+)	-0,009	-0,009(+)	-0,008	-0,008(+)
Weekly Jobless Claims	0	0(+)	-0,001	0(+)	-0,001	0(+)	-0,001	-0,001(+)	-0,002	-0,001(+)
Building Permits	-0,014	-0,013(+)	-0,012	-0,011(+)	-0,012	-0,011(+)	-0,013	-0,012(+)	-0,013	-0,012(+)
Empire Manufacturing	0,011	0,011	0,008	0,01	0,007	0,005	0,008	0,009	0,004	0,002
Personal Consumption	-0,008	-0,006	-0,005	-0,005(+)	-0,005	-0,005	-0,002	-0,003(+)	-0,004	0,002(+)
Indice Help Wanted	0,004	0,01(+)	0,004	0,011(+)	0,002	0,011(+)	0,003	0,012(+)	0,002	0,01(+)
NAHB Housing Market Index	-0,011	-0,011(+)	-0,012	-0,012(+)	-0,013	-0,013(+)	-0,012	-0,012(+)	-0,015	-0,015(+)
Construction Spending	0,016*	0,012(+)	0,018**	0,014*(+)	0,018**	0,014**(+)	0,02**	0,016**(+)	0,021**	0,017**(+)

Table 12: Intercept estimation: intercept 1 is the intercept from the model 1; intercept 2 is the intercept from model 2. * and ** denotes estimates that are significative up to a 10% and 5% risk level. + denotes that the null of the LR test of model 1 against model 2 is rejected. (a)

	15 year		20 year		30 year	
	Intercept 1	**Intercept 2**	**Intercept 1**	**Intercept 2**	**Intercept 1**	**Intercept 2**
Household consumption	0,009*	0,011**	0,006	0,009(+)	0,009*	0,011**(+)
Personal Income	0,009*	0,009*(+)	0,006	0,006(+)	0,008*	0,008*(+)
ISM manuf	0,012**	0,017**(+)	0,01*	0,014**(+)	0,008	0,012**(+)
Industrial New orders	0,004	0,002(+)	0,004	0,003(+)	0,005	0,004(+)
Construction Spending	0,002	0,005(+)	0,001	0,004(+)	-0,002	0(+)
Consumer Credit	0,002	0,004(+)	0,001	0,003(+)	0	0,002(+)
Wholesale Inventory	0,001	-0,002(+)	0	-0,002(+)	-0,002	-0,004(+)
Retail Sales	0,002	0,003(+)	0,001	0,002(+)	0,002	0,002(+)
Industrial Production	-0,009	-0,008(+)	-0,007	-0,007(+)	-0,008	-0,008(+)
Housing Start	-0,011*	-0,01(+)	-0,008	-0,006(+)	-0,007	-0,006(+)
Philifed Index	0,002	-0,001(+)	0,001	-0,002(+)	-0,001	-0,004(+)
Existing Home Sales	0,011**	0,01**(+)	0,01**	0,009*(+)	0,008*	0,007*(+)
Conf. Board Consumer Conf.	-0,001	0(+)	-0,001	0,001(+)	-0,001	0,001(+)
GDP	0	-0,003(+)	-0,004	-0,007(+)	-0,004	-0,008(+)
Chicago PMI	-0,019**	-0,019(+)	-0,019**	-0,019	-0,019**	-0,019(+)
New Home Sales	-0,009	-0,008(+)	-0,008	-0,007(+)	-0,006	-0,006(+)
Consumer Price Index	-0,011*	-0,011(+)	-0,011*	-0,011(+)	-0,012**	-0,011(+)
Unemployment Rate	-0,003	0,001(+)	-0,004	-0,001(+)	-0,005	-0,002(+)
Trade Balance	-0,007	-0,006(+)	-0,009	-0,008(+)	-0,005	-0,004(+)
Jobless Claims	0,001	0,001(+)	0,001	0,001(+)	0	0(+)
Non Farm Payroll	0,005	0,003(+)	0,003	0(+)	0,001	-0,001(+)
Capacity Utilization Rate	-0,013	-0,01(+)	-0,01	-0,007(+)	-0,015*	-0,013(+)
Employment Cost Index	0,005	0,009	-0,002	-0,002	-0,008	-0,005
Wages	-0,012	-0,018(+)	-0,012	-0,02(+)	-0,013	-0,014(+)
Productivity	-0,003	-0,002(+)	-0,003	-0,004(+)	0,001	0,002(+)
Durable Good Orders	-0,001	0,001(+)	0	0,002(+)	0,002	0,004(+)
Producer Price Index	-0,004	-0,004(+)	-0,006	-0,006	-0,007	-0,007
Hourly Average Wages	0	0,006(+)	-0,001	0,004(+)	-0,004	0,001(+)
Non Manuf. ISM	-0,003	0,001(+)	-0,002	0(+)	-0,002	0,002(+)
Weekly Working Hours	0,002	0(+)	0	-0,002(+)	-0,004	-0,005(+)
Consumer Conf. Michigan	-0,001	0(+)	-0,002	0(+)	-0,003	-0,001(+)
GDP after 1999	-0,008	-0,007(+)	-0,008	-0,008(+)	-0,011	-0,011(+)
Weekly Jobless Claims	-0,002	-0,001(+)	-0,002	0(+)	-0,001	0(+)
Building Permits	-0,014	-0,013(+)	-0,013	-0,012(+)	-0,011	-0,01(+)
Empire Manufacturing	0	-0,002	-0,002	-0,004	-0,003	-0,003
Personal Consumption	-0,001	-0,002(+)	-0,003	0(+)	-0,006	-0,003(+)
Indice Help Wanted	0,001	0,01(+)	0,001	0,009(+)	0	0,004(+)
NAHB Housing Market Index	-0,017*	-0,017(+)	-0,018*	-0,018(+)	-0,016*	-0,016(+)
Construction Spending	0,02**	0,016**(+)	0,02**	0,016**(+)	0,02**	0,017**(+)

Table 13: Intercept estimation: intercept 1 is the intercept from the model 1; intercept 2 is the intercept from model 2. * and ** denotes estimates that are significative up to a 10% and 5% risk level. + denotes that the null of the LR test of model 1 against (3) is rejected. (b)

Indicator	Condition	Pattern
Household Consumption	PMI $<$ 48	Factor 4
Personal Income	FACT1 $>$ 94	Factor 1
Personal Income	FED $<$ 3,25	Factor 1
ISM manuf	PMI $<$ 60	Factor 1
Industrial New orders	PMI $<$ 42	Factor 1
Construction Spending	FACT1 $<$ 69	Factor 4
Construction Spending	PHI $<$ -5	Factor 1
Consumer Credit	MICH $>$ 94	Factor 1
Wholesale Inventory	PMI $<$ 50	Factor 2
Retail Sales	MICH $>$ 80	Factor 2
Industrial Production	PMI $<$ 50	Factor 2
Housing Start	FACT1 $<$ 68	Factor 1
Philifed Index	PMI $>$ 42	Factor 1
Existing Home Sales	PMI $>$ 50	Factor 4
Conf. Board Consumer Conf.	FED $>$ 3,5	Factor 2
GDP	FACT1 $<$ 85	Factor 1
GDP	PMI $<$ 51	Factor 3
GDP	PMI $>$ 51	Factor 1
GDP	FACT1 $<$ 85	Factor 1
Chicago PMI	MICH $>$ 95	Factor 4
Chicago PMI	MICH $<$ 95	Factor 1
New Home Sales	PMI $<$ 60	Factor 1
Unemployment Rate	PMI $<$ 60	Factor 1
Consumer Price Index	MICH $>$ 98	Factor 1
Trade Balance	PMI $>$ 50	Factor 1
Jobless Claims	PMI $>$ 40	Factor 1
Non Farm Payroll	FACT1 $>$ 97	Factor 1
Non Farm Payroll	FACT1 $<$ 97	Factor 1
Capacity Utilization Rate	FED $<$ 3,5	Factor 1
Employment Cost Index	CONF $>$ 110	Factor 1
Wages	PMI $>$ 48	Factor 2
Durable Good Orders	FED $>$ 2	Factor 1
Durable Good Orders	PMI $>$ 52	Factor 3
Durable Good Orders	PMI $<$ 52	Factor 3
Producer Price Index	FED $>$ 3,25	Factor 2
Hourly Average Wages	PMI $>$ 50	Factor 3
Import Price Index	PMI $>$ 50	Factor 3
Non Manuf. ISM	PMI $<$ 60	Factor 2
Weekly Working Hours	CONF $>$ 92	Factor 1
Consumer Conf. Michigan	CONF $>$ 110	Factor 1
GDP after 1999	CONF $<$ 130	Factor 2
GDP after 1999	CONF $>$ 105	Factor 2
Weekly Jobless Claims	PMI $<$ 57	Factor 2
Building Permits	PMI $<$ 50	Factor 1
Empire Manufacturing	PMI $<$ 55	Factor 1
Personal Consumption (Q)	PMI $>$ 55	Factor 4
Indice Help Wanted	PMI $<$ 51	Factor 1
NAHB Housing Market Index	PHI $>$ 11	Factor 1
Construction Spending	PHI $<$ 2	Factor 1
Construction Spending	PMI $<$ 54	Factor 2
Construction Spending	PHI $>$ 2	Factor 3

Table 14: Results of the estimation of the model defined by equation (16) and identification of the factors of the yield curve