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Financial Variables as Predictive Indicators of the Luxembourg GDP Growth

Sabbah Gueddoudj[1]

Abstract

The last financial crisis has had negative impacts on economic growth underlining the contagion between the financial sphere and the real sphere. Indeed, in many developed economies the aggregate production fell abruptly during the financial turbulences period. Now the problem is to understand how a financial crisis creates such a contagion. The answer may partly lie in the role of financial variables in the economic growth outlook. In this paper, we analyze the predictive power of some relevant financial variables to forecast the GDP growth in Luxembourg by implementing a Mixed Data Sampling model developed by Ghysels, Sinko, and Vuksic (2007). Both financial and non-financial variables are introduced such as stock index, monetary aggregates (M1 and M2), industrial production index (I.P.I) and mutual fund's N.A.V. (Net Asset Value). The industrial production index (I.P.I) is used as a benchmark. According to our estimations, the stocks index and mutual funds' N.A.V outperform the industrial production index. Considering the role of finance in Luxembourgish economic growth, this result is not surprising. M1 outperforms the I.P.I over the long-term run.

Keywords*:* Financial Volatility, GDP Forecast, MIDAS Approach
JEL Classifications**:** C53, E37

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1. Introduction

The last financial crisis of 2018 accompanied by a severe drop of GDP for most of the countries has restarted the debate on the link between the real sphere and the financial sphere (Cecchetti, Kohler, & Upper, 2009; Furceri & Mourougane, 2012; Fernald, 2014; Aydin & Malcioglu, 2016; Romer & Romer, 2017). Indeed, the debate on the interaction between finance and production is not new (Schumpeter, 1934; Goldsmith, 1969; McKinnon, 1973; Shaw, 1973; Diamond & Dybvig, 1983; King & Levine, 1993; Levine, 1997, 2005). The crises' recurrence leads researchers to develop in depth analysis of the interaction between the real sphere and the financial sphere. Fink, Haiss, and Vuksic (2009) found that financial development has positive growth effects in the short run rather that in the long run. They also underlined the role of well-functioning financial intermediaries as Bonin and Watchel (2003). Given the above, there is no possible doubt that finance and production spheres are interconnected.

Moreover, the stock market reflects the economic development. If an economy is growing then output will be more important and most firms should be experiencing higher profitability. This higher profit makes the company shares more attractive – because they are expected to provide shareholders with higher yields tomorrow. If the economy goes into a recession, then stock markets will generally collapse. The narrow link between stock market and economic growth has been underlined by Levine (1997), Filer, Hanousek, and Nauro (1999), Wang (2002) and Liao, Liu, and Wang (2011). They all demonstrated that over the short term there is a positive link between growth and stocks market developement, but the link turns out to be negative on the long term. This relationship between growth and market variables indicates that financial variables should be introduced in any GDP forcasting exercises. It is well known that the funds' industry is an alternative to the banking fundings. We must bear in mind that the principal activity of mutual funds is to pool savings and make investments for investors. This makes funds a great type of financial intermediary.

To be in line with the charactristics of the Luxembourguish economy, mutual funds are taken into consideration since they have grown rapidly in the recent years. Indeed, according to the financial authority of Luxembourg, from 1990 to 2017 there is a great development of funds' industry in Luxembourg. The number of mutual funds was 805 in 1990, in 2017 it is 4, 044. Morever, the total net asset value (N.A.V) soared: +166.65% from 2008 to 2017. Important presence of the funds, depends likely not only on the size and economic development of the country, but also on internal laws or on tax benefits. The Luxembourguish government encourages this sector by providing an attractive environment for the fund industry. This latter allows investors to react timely and optimally to market demand changes by creating innovative products. Nowadays, Luxembourg is the leading European investment fund center (the second worldwide just after the United States). For Luxembourg, we observe a positive correlation between N.A.V. of mutual funds and GDP (68%). Moreover, the empirical and economic literature shows that the mutual fund's N.A.V (Net Asset Value) impact the business cycle. According to Lynch and Wachter (2013) works based on a Fama-French and Carhart pricing models, mutual fund performances move with the output cycle and the impact of this latter on funds depends on the N.A.V size. This conclusion should lead us to consider mutual funds as a predictive indicator of the Luxembourgish GDP.

In the light of foregoing, we use various financial, real and monetary variables to implement GDP growth forecasts. In this respect, we use a Mixed Data Sampling (MIDAS)-based modelling approach, put forward by Ghysels et al. (2007), that enables us to forecast the quarterly GDP growth rates using exogenous variables sampled at different frequencies (days, months and quarters). Forecasting macroeconomic variables is a key task for national and international institutions, namely for the Central Banks. Nevertheless, most of the important macroeconomic indicators are not sampled at the same frequency. GDP for instance is sampled at a quarterly frequency but it may be related to other variables such as the industrial production index which is sampled on a monthly basis or other financial variables sampled daily.

The simplest solution is to change the frequency by reducing the frequency of the highest frequency variables and run estimations but this solution is not optimal since it erases the inner processes of the variables and erases any informative content of the variable due to its nature (for example for daily variables the volatility is reduced or even vanished). To avoid these kinds of limits, Griliches, Santa-Clara, and Valkonov (2004) propose a general framework called mixed data sampling (MIDAS). Thanks to the flexibility of the model and simplicity of its use, this approach has been often used and well developed. Galvao (2013) proposed a MIDAS framework in a smooth transition autoregression to provide changes in a higher frequency variables forecasting ability. Clements and Galvao (2008) created a common factor to the MIDAS model with an autoregressive (AR) component. Kuzin, Massimiliano, and Schumacher (2011) incorporated a vector autoregression (VAR) to boost the AR-MIDAS model. The MIDAS approach regarding its importance for forecasting exercises continues to be a topic of discussions and continually improved.

In line with Ferrara, Marsilli, and Ortega (2014), we use financial variables and production variables as explicative variables and estimate MIDAS models on Luxembourg dataset over the pre-crisis study period going from 1 January 1995 to 31 March 2007. We then implement the out-of sample recursive forecasts over the 1 April 2007 – 31 December 2009 period based on the financial and non-financial variables and we compare these forecasting performances to a benchmark. The industrial production index is used for the benchmark forecasts.

The rest of the paper is structured as follows. The second section presents MIDAS methodology and the data used for the forecasting exercises. The third section discusses the main results. The last section provides a conclusion.

2. Research Methodology and Data Collection

The standard MIDAS regression (Ghysels, Santa-Clara, & Valkanov, 2007) is described by the following relation:

$$y_t = \alpha_0 + \alpha_1 B(\theta) x_t^m + \phi y_{t-1} + \varepsilon_t \qquad (1)$$

With (x_t^m) denotes the exogenous stationary variables at a frequency higher than (y_t) and $B(\theta)$ controls the weights that determines the frequency mixing. $B(\theta)$ is given by the following equation:

$$B(\theta) = \sum_{j=1}^{J} b_j(\theta) L^{(j-1)/m,d} \qquad (2)$$

$$b_j(\theta) = b_j(\theta_1, \theta_2) = \frac{e^{(\theta_1 j + \theta_2 j^2)}}{\sum_{1}^{J} e^{(\theta_1 j + \theta_2 j^2)}} \qquad (3)$$

The parameter θ is the key parameter for the model. The Almon lag polynomial relation has been chosen because of its parsimonious and reasonable restrictions. Indeed, only two exponential parameters Almon lag are introduced and are assumed to be always positive.

We estimate the MIDAS model on Luxembourg data. We implement forecasts for quarterly GDP growth for Luxembourg. We use a set of explanatory variables namely, Brent, Gold, M1, M2, and S&P 500. We have chosen these variables for several reasons related to economic literature. Indeed, the commodity prices are generally assumed to be a good proxy for anticipations. During the period of financial turmoil, commodities are seen as a safe investment. Stock indices and monetary aggregates are taken into account since they are good proxies for financial and monetary developments. We also use the industrial production index (I.P.I), which measures production output and underlines structural developments in the economy (Asgharian, Hou, & Javed, 2013; Cimadomo & D'Agostino, 2016). Finally, we use I.P.I will be used as a benchmark.

The databases come from the Central Bank of Luxembourg (B.C.L), the *Institut national de la statistique et des études économiques of Grand-Duché de Luxembourg* (S.T.A.T.E.C) and the European Central Bank Statistical Data Warehouse (E.C.B-S.D.W).

Table 1: Database

Variables	**Description**	**Filter**
Real output	GDP growth (chain-linked GDP)	Quarterly growth rate
Financial Variables		
Stocks index	DJ50 (Dow Jones 50)	Monthly growth rate
Money market fund	Mutual funds'N.A.V	Monthly growth rate
Monetary aggregate	M1 and M2	Monthly growth rate
Benchmark	Industrial Production Index	Monthly growth rate

Sources: BCL, STATEC and SDW-ECB

3. Results

We implement forecasts for quarterly GDP growth rates using growth rates of I.P.I, M1, M2, N.A.V and DJ 50.

By using each of the high-frequency variables, we first estimate equation (2) over the period 1995Q1-2007Q1 and then we implement a recursive out-of sample experience over the crisis period from 2007Q2 to 2009Q4 and for 13 horizons (h= 0 to 12).

In this paper, for Luxembourg we define four univariate MIDAS regressions based on the four financial variables described above (see Table 1). In order to evaluate the predictive power of the forecasts, we compare them with those get from benchmark MIDAS model based on the Industrial Production Index (I.P.I). For each horizon, we present in table 2 the ratio of Root Mean Squared Forecasting Errors (RMSFEs) of GDP growth between the financial MIDAS models and the benchmark I.P.I MIDAS model. The ratio is defined by:

$$R^{h}_{fv,IPI} = \frac{RMSE^{h}_{financial\_MIDAS}}{RMSE^{h}_{IPI\_MIDAS}} \quad \textbf{(4)}$$

With *fv=financial variables and I.P.I=Industrial Production Index. Where RMSE is the root mean squared error of forecast.*

Table 2: Ratio Results

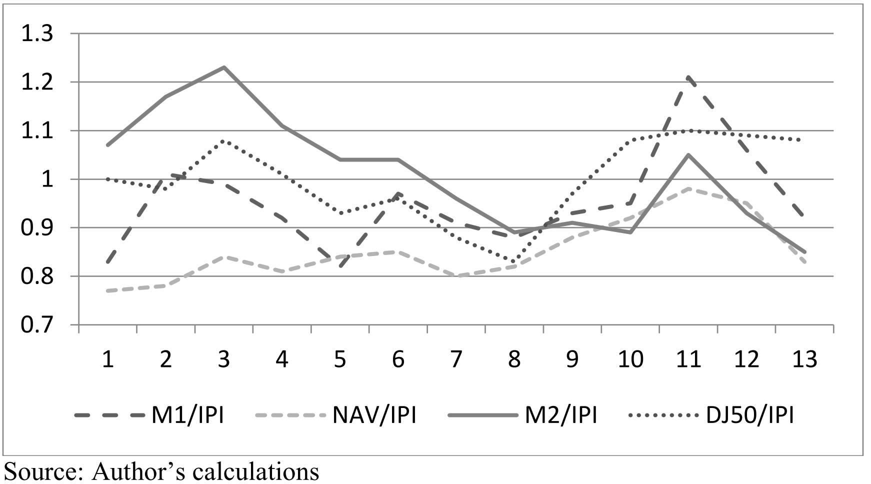
Hori/ Var	***h=0***	***h=1***	***h=2***	***h=3***	***h=4***	***h=5***	***h=6***	***h=7***	***h=8***	***h=9***	***h=10***	***h=11***	***h=12***
NAV/ IPI	0.83	1.01	0.99	0.92	0.82	0.97	0.91	0.88	0.93	0.95	1.21	1.06	0.92
DJ5/ IPI	0.77	0.78	0.84	0.81	0.84	0.85	0.80	0.82	0.88	0.92	0.98	0.95	0.83
M1/ IPI	1.07	1.17	1.23	1.11	1.04	1.04	0.96	0.89	0.91	0.89	1.05	0.93	0.85
M2/ IPI	1.00	0.98	1.08	1.01	0.93	0.96	0.88	0.83	0.97	1.08	1.10	1.09	1.08

The results displayed in Table 2 and the Charts 1 strengthen some standard findings useful for the practitioners. The following paragraphs explain why the practitioners should take into account the main conclusions in their forecasting analysis.

First, financial MIDAS models are more relevant for medium term analysis comparing to I.P.I MIDAS model. Indeed, from h=6 to h=8, all financial variables models outperform the benchmark since all ratios are systematically less than one. It turns out that financial MIDAS models improve the benchmark MIDAS model for three horizons (from h=6 to 8). Thus, this result indicates that Luxembourg is a financial place.

Second, for all MIDAS models, the gain is not uniform through the different horizons. As already mentioned, the optimal forecast horizon lies between 6 and 8 months. A more detailed analysis shows that globally, Stocks index variable outperforms the benchmark whatever the forecasting horizons, which is an important result. This means that DJ50 index is more important to get accurate macroeconomics forecasts than I.P.I, often supposed to be the best predictive variable. Beside, this conclusion is useful for the statistical organizations in charge of short-term GDP forecasting exercises.

Figure 1: Evolution of $R^{h}_{fv,IPI}$ according to h



Source: Author's calculations

Mutual fund's N.A.V. ratios are most of the time less than one for the short-term (except for h=1) and the long-term horizons (excluded h=10 and h=11) which means that N.A.V of mutual fund provides better forecasts of the GDP growth than the Industrial Production Index. This result is not surprising since the short-term linkage between GDP and financial variables such as stocks and mutual funds have extensively been described by the empirical literature (Chan-Lau, Espinosa, Giesecke, & Sole, 2009; Kuosmanen & Vataja, 2014).

An interesting remark holds for M1, monetary aggregate. The definition of the narrow monetary aggregate M1 is currency in circulation and overnight deposits. M1 improves forecasts after h=6 by comparison with the I.P.I. Some empirical works show that M1 has better and more robust forecasting properties for real GDP than other variables (Brand, Reimers, & Seitz, 2003). This result has been underlined by the theoretical and empirical literature. A long-run relationship exists between narrow money (M1) and nominal GDP

M2 consists of savings deposits, small-denomination time deposits, and retail money funds in addition to M1. The conclusions are not so obvious. Indeed, the optimal forecast horizon lies between 4 to 8 months. After h=8, the I.P.I outperforms. For h=1, the ratio is less than one. These results may puzzle us. However, the hybrid character of M2 may explain it. It mixed liquid assets (M1) and less liquid assets such as retail money funds. This mixed variable may cause results heterogeneity. It is not possible to provide an assertive conclusion for this variable to practitioners.

4. Conclusion

In this paper, we explore the performances of financial variables when forecasting the GDP growth during the financial instability periods. We run the MIDAS models with an industrial production index as a benchmark for predicting Luxembourg GDP. We also introduce several financial variables (mutual funds and stock index), monetary variables (M1 and M2) and a hard variable (I.P.I). The results based on a comparison of the forecasting ability of four financial variables often used to evaluate the GDP determinants are in line with financial center countries such as Luxembourg.

Indeed, stocks prices and mutual funds provide significantly better results in forecasting GDP. They globally outperform I.P.I. Moreover, the role of the supply of money is very relevant for the economic growth during the long-term period. It is a standard result and it may reinforce the idea that the role of money in growth is not linear. An acceleration of money growth is often interpreted as a signal of economic recovery. The growth of the money supply is an important variable in interpreting the outlook for the output cycle and inflation in the environment of the monetary policy of central banks (Baumol, 1957; Tobin, 1952, 1958; Borio & Disyatat, 2011; Kim & Seol, 2012).

From the results that we obtain, it turns out that financial variables play a fundamental role since they help to improve Luxembourgish GDP forecasts by comparison to the I.P.I.

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