

Winter Is Coming? How to Anticipate a Recession Based On the Knut Wicksell's Rate of Interest theory

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Abstract

Objective: This article assesses the possibility of the Wicksell's index to predict a recession or at least a strong GDP's decrease. The Wicksell's index is simply calculated as the difference between the monetary interest rate and the natural interest rate, defined as the growth rate of firms' result.

Methods: Two steps based on several correlations tests have been carried out. The first step was to check the correlation between the GDP and firm's result to see if the second is relevant to be considered as the "simplified" natural growth rate of the economy. The second step was to check the correlation between the Wicksell's index and the GDP. The tests have been conducted for 3 countries: Germany, Poland and Spain, and for data from 2005 to 2021.

Results: It is observed that the Wicksell's index works well in anticipating a recession or at least a strong decrease of the GDP.

Conclusions: The Wicksell's index should be an interesting tool in anticipating a recession or at least a strong GDP's decrease.

Christophe Cathala designed the experiment. Christophe Cathala supervised the work. Christophe Cathala performed the data analysis. Christophe Cathala drafted the manuscript. The author contributed to writing the article, read and approved its submission.

1. Introduction

Looking at economic activity is like looking at a sea with tides. In both case, a calm level is not guaranteed and higher or lower sea levels could be met. The economic activity is the same, it moves between period of expansion and periods of recession. Economic activity like the life is not a long quiet river. The move for the economic activity is between expansion and recession, between a period with economic growth and a period with economic contraction. Taking together, the whole bears the name of business cycle.

As stated by Fornari and Lemke (2010¹), "*there is a vital interest in tools for forecasting the ups and downs of the business cycle*". In fact, investment decisions and government policies require a reasonable knowledge of the state of economy in the medium term at least. Analysing the question of whether there will be a slowdown or an expansion is an essential piece of information for decision makers at micro or macro levels. Measurement is all about decision making.

¹Fornari, F. & Lemke, W., (2010). "Predicting recession probabilities with financial variables over multiple horizons". Working Paper Series 1255, European Central Bank.

To analyse the evolution of the business cycle, the immediate gauge which comes to everybody's minds is the GDP, the Gross Domestic Product, as it is the broadest gauge of overall economic conditions. Simply speaking, the GDP is the measure of the final goods and services' value produced within a country, a region or the world. It is the difference between the total expenditure, the output, and the total income, the input. It may be calculated from the value of goods and services produced by private industry and government, less the value of goods and services used up in production or from the sum of personal consumption expenditures, gross private domestic investment, net exports of goods and services, and government consumption expenditures and gross investment. According to the definition, the GDP is not easy and fast to be calculated but it requires a lot of parameters which must be estimated at the same time to get the relevant figure. That means estimating and forecasting the growth rates of the GDP to determine if the economic activity goes to recession or expansion phases could be time-consuming and tricky as it means anticipating several variables interrelated at the same time. However, an order of events could provide immediate hints on the means the economic activity went and could go. For instance, an unexpected increase in inventories of unsold goods, both accompanied with and followed by business surveys indicating a general softening in demand could anticipate a recession. Monetarists applied a different approach. They look at the investing yield curve and in the event when the short-term rates set by the central bank are becoming too high for business conditions, the same conclusion of a probable recession to come is reached. A different approach is followed in the current article. Such approach is based on the works of the Swedish economist Knut Wicksell. As stated by him in 1907², *"the rate of interest is never high or low in itself but only in relation to the profit which people can make...and this of course varies. In good times, when trade is brisk, the rate of profit is high, and, what is of great consequence, is generally expected to remain high; in periods of depression it is low, and expected to be low. The rate of interest on money follows, no doubt, the same course"*. The objective of the current article is to examine the relevance of the relationship between the market rate of interest and the natural rate of the growth of the economic activity in order to estimate and to anticipate a recession.

2. Literature Review

*"GDP is a very strong measure to gauge the economic health of a country...It is used as an indicator by almost all the governments and economic decision-makers for planning and policy formulation. It enables one to judge whether the economy is contracting or expanding, whether it needs a boost or restraint, and if a threat such as a recession or inflation looms on the horizon"*³. The first question to be asked is: how is it computed? Simon Kuznets, an economist at the National Bureau of Economic Research (NBER), is often presented as the economist who first made the original formulation of the GDP. His idea was to capture all economic production (of goods and services) within a country during a period of time in a single measure. The GDP was made as a representation of the total market value of finished goods and services produced. Mathematically, it is the sum (Y) of a nation's level of consumption (C), investment (I), government spending on goods and services (G), and the difference in profit between exports and imports (NX).

$$Y = C + I + G + (NX)^4$$

The definition proves that the GDP is not easy to compute and is not fast to get all figures reliable and usable. That explains why other mechanisms have been created to get a faster reliable manner to anticipate and to observe a recession. Recession refers to a contraction of the economy. According to Claessens and Kose (2009⁵), *"there is no official definition of recession, but there is general recognition that the term refers to a period of decline in economic activity"*. Usually the two major components of the GDP, consumption and investments, decline during the recessionary period. Business cycle shows *"weak economic phases were duration, depth and diffusion exceed the usual bounds"* (Arberger and Nierhaus, 2008⁶). However, at which level is a downturn in

²Wicksell, K., (1907). *"The Influence of the Rate of Interest on Prices"*. The Economic Journal, 17, pp213-220.

³Jain, D. and Nair, K. and Nair, K. and Jain, V., (2015). *"Factors Affecting GDP (Manufacturing, Services, Industry): An Indian Perspective (April 11, 2015)"*. Annual Research Journal of SCMS Pune, Vol. 3, April 2015, pp. 38-56.

⁴Mankiw, G., (2017). *"Principles of Macroeconomics"*. Cengage Learning; 8th edition (January 1, 2017), pp.576.

⁵Claessens, S., and Kose, A., (2009). *"Back to Basics, What is a recession?"*. IMF, Finance & Development March 2009, pp.52-53.

⁶Arberger, K., & Nierhaus, W. (2008). *"How to define a recession?"*. CESifo Forum, 9(4), 74-76.

the economy sufficiently severe to be deemed a recession? The answer is not simple. According to an old rule of thumb attributed to Julius Shiskin in the New York Times⁷, a recession is a period of at least two consecutive quarters of declining real GDP. The problem is that sometimes a recession exists with two quarters of declining real GDP but not consecutive. That was the case with the recession of 2001. The absence of two consecutive negative quarterly growth rates in the GDP would have denied the existence of the severe Japanese recession of the mid-1970s. That is why, for Economists, it requires a deep analysis of economic time series to estimate the starting and ending dates of recessions. Coming back to the GDP, Layton and Banerji (2003⁸) have made a deep analysis of the use of the GDP to justify that such metrics are subject to certain limitations in looking at periods of recession (or crisis) and they conclude that “a GDP measure alone, whether monthly or quarterly, is even less appropriate”. Another metrics have been examined. For instance, Keegan and al. (2012⁹) have prepared an index which combines the GDP, the unemployment rate and the public debt to obtain more explanation for the variation in health expenditure growth than the GDP dynamics alone. Bengoechea and Quirós (2004¹⁰) have worked on the identification and the periods of the European business cycle and they have found that the European Commission industrial confidence indicator (ICI) is very useful and relevant to identify the current and future European business cycle. More recently, Huang and Yan (2023¹¹) use machine learning models (VAR, SVR, Random Forest, and LSTM) to forecast economic recessions and the result was not very relevant and better prediction was not guaranteed compared to traditional VAR model. In the current article, the focus is made on financial cycles as indicator of recessions. Several authors like Borio and Drehmann (2009¹²), Schularick and Taylor (2012¹³), Detken et al (2014¹⁴) have shown that financial cycles are leading indicators of financial crises. Borio and al. (2019¹⁵) analyse deeply the message transmitted by financial cycle and reach the conclusion that “financial cycle proxies contain valuable information in evaluating recession risks; and they tend to outperform”. Staying in the field of financial sector, a famous predictor of economic growth is the slope of the yield curve, the difference between the yields on short- and long-term maturity bonds. Estrella and Mishkin (1998¹⁶) talk about a “consensus” of the inverted yield curve as the best signals of impending recessions. The yield curve inverted in May 2019, almost a year before the most recent recession started in March 2020. Rudebusch and Williams (2009¹⁷) “find that a simple model for predicting recessions that uses only real-time yield curve information would have produced better forecasts of recessions at horizons beyond two quarters than the professional forecasters provided”. More recently, Croushore & Marsten (2014¹⁸) replicate and update the main results of Rudebusch and Williams (2009) and reach the conclusion that the findings are robust in all dimensions, the use of the yield spread can predict recessions better than the Survey of Professional Forecasters. The purpose of the article is to stick to the financial sector but to base the analysis on the works of the Swedish economist Knut Wicksell¹⁹ and his definition of the natural rate of interest as the interest rate compatible with

⁷Shiskin, J. (1974). “The Changing Business Cycle”. The New York Times, Section 3, p.12 (December,1).

⁸Layton, A. P., & Banerji, A. (2003). “What is a recession?: A reprise”. Applied Economics, 35, 1789–1797.

⁹Keegan, C. & Thomas, S. & Normand, C. & Portela, C., (2013). “Measuring recession severity and its impact on healthcare expenditure”. International Journal of Health Economics and Management, Springer, vol. 13(2), pages 139-155, June.

¹⁰Bengoechea, P. & Quirós, G.P., (2004). “A useful tool to identify recessions in the euro area”. European Economy - Economic Papers 2008 - 2015 215, Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

¹¹Huang, Y. and Yan, E. (2023). “Economic Recession Forecasts Using Machine Learning Models Based on the Evidence from the COVID-19 Pandemic”. Modern Economy, 14, 899-922. doi: 10.4236/me.2023.147049.

¹²Borio, C. and Drehmann, M., (2009). “Assessing the risk of banking crises – revisited”. BIS Quarterly Review, March, pp 29–46.

¹³Schularick, M. and Taylor, A., (2012). “Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870–2008”. American Economic Review, vol 102, no 2, pp 1029-61.

¹⁴Detken, C., Weeken, O., Alessi, L., Bonfim, D., Boucinha, M., Castro, C., Frontczak, S., Giordana, G., Giese, J., Jahn, N., Kakes, J., Klaus, B., Lang, J-H., Puzanova, N. and Welz, P., (2014). “Operationalising the countercyclical capital buffer: indicator selection, threshold identification and calibration options”. European Systemic Risk Board, Occasional Papers, no 5.

¹⁵Borio, C., Drehmann, M. and Dora, X., (2019). “Predicting recessions: financial cycle versus term spread”. No 818, BIS Working Papers, Bank for International Settlements.

¹⁶Estrella, A. and Mishkin, F., (1998). “Predicting US recessions: financial variables as leading indicators”. Review of Economics and Statistics, vol 80, no 1, pp 45–61.

¹⁷Rudebusch, G.D. & Williams, J.C., (2007). “Forecasting recessions: the puzzle of the enduring power of the yield curve”. Working Paper Series 2007-16, Federal Reserve Bank of San Francisco.

¹⁸Croushore, D. & Marsten, K., (2014). “The continuing power of the yield spread in forecasting recessions”. Working Papers 14-5, Federal Reserve Bank of Philadelphia.

¹⁹Wicksell, K., (1898). “Interest and Prices: A Study of the causes regulating the value of money”. English translation, London: Macmillan and Company, 1936, p. 102.

a stable price level. In Wicksell's view, a market interest rate which equals to its natural counterpart guarantees economic stability. A recession should occur once the disbalance is observed. It is the hypothesis which is to be checked in the following article.

3. Research Method

Following Wicksell's view, two variables should be observed: the market interest rate (Mir) and the natural interest rate (Nir). When Interest rates are equal to the natural rate, economic stability is observed. Market interest rates above the natural rate slow economic activity, while they are below, they stimulate the economic activity.

As a summary:

Mir = Nir → Economic activity stable

Mir > Nir → Economic activity weak or recession

Mir < Nir → Economic activity stimulated

- For the market interest rate, the data observed is the Long-Term Government Bond Yields: 10-Year.
- For the natural rate of interest, it is more tricky. The natural rate of interest may not be gauged directly and it is influenced by various factors (Rachel and Smith, 2015²⁰) making it very challenging to get precise measurements.

The hypothesis followed in the current article based on Wicksell's definition is that it is the rate consistent with output being at its natural rate. With regard to the output, the analysis is narrowed on firms only due to the fact that they have a direct impact on Consumption, on Investment and on Net Export. The variable used here is the net result. The growth of the firm's net result will be the natural rate as it is the indicator applied to grasp the profit growth rate of the economy. The BACH database (www.bach.banque-france.fr) is used for empirical observations. The period analysed includes seventeen years, from 2005 to 2021 and the analysis involves three countries: Germany, Poland and Spain. As the website states, "the data is based on the annual statistical financial statements collected by Central Statistical Office. The survey comprises enterprises of more than 9 employees". The research method is built from the comparison between the market interest rate, the Long-Term Government Bond Yields: 10-Year and the natural rate, the profit growth rate of the economy, based on the observation of the growth of firm's net result. Such comparison is named "Wicksell's index". When the first is above the second, the Wicksell's index is weak and a recession or at least a decrease in the GDP growth is expected.

The GDP growth (annual %) is taken from the World Development Indicators (<https://databank.worldbank.org/source/world-development-indicators>). A recession is considered when the GDP growth (annual %) is below 0.

Four correlations tests will be used. The first one is a correlation table where the evolution of our 2 variables are observed. The second is a correlation chart. The third is a correlation coefficient calculated mathematically as

follow: $r_{i,j} = \text{Cor}(X_i, X_j)$. The last one is the correlation ranking.

4. Research Result

There are two steps to be followed in the analysis.

The first one is to check the correlation between firms' net result and the GDP to estimate if the hypothesis to use firms' net result as the profit growth rate of the economy is relevant.

The second one is to check if the Wicksell's index is an indicator correlated with the GDP growth.

²⁰Rachel, L., Smith, T.D., (2015). "Secular drivers of the global real interest rate". Bank of England Staff Working Paper No. 571 (2015) December.

▪ **The positive correlation between net results and the GDP growth**

A correlation test has been carried out for 3 countries.

The correlation test is made between the change of firm’s net result year per year and the GDP change year per year from 2005 to 2021.

For each country, 3 tests are carried out to check the correlation: a correlation table per year, a correlation chart and a mathematical test based on the following formula:

$$r_{i,j} = \text{Cor}(X_i, X_j)$$

1. Germany

As discussed above, the below correlation table per year shows that in 13 cases over 16 cases, the trend is the same between the change in firm’s net result and the GDP. The conclusion confirms the correlation.

Table 1²¹: Correlation table between change in firms’ net result and the GDP for Germany from 2006 to 2021

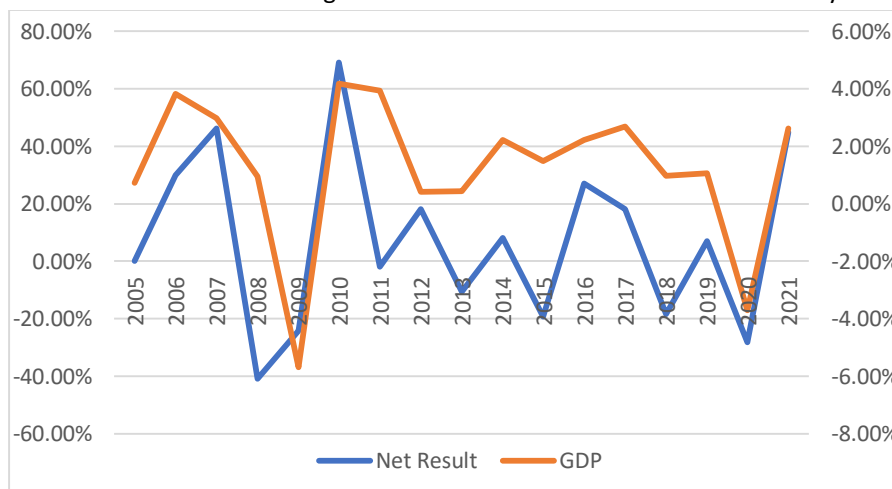
NET RESULT	GDP	TREND
Growth	Growth	Same
Growth	Reduction	Different
Loss	Reduction	Same
Loss	Recession	Same
Growth	Growth	Same
Loss	Reduction	Same
Growth	Reduction	Different
Loss	Growth	Different
Growth	Growth	Same
Loss	Reduction	Same
Growth	Growth	Same
Growth	Growth	Same
Loss	Reduction	Same
Growth	Growth	Same
Loss	Recession	Same
Growth	Growth	Same

Source: prepared by the author

The correlation chart is now discussed below.

The slopes is quite the same in both cases confirming the correlation between the 2 set of data.

Table 2²²: Correlation chart between change in firms’ net result and the GDP for Germany from 2005 to 2021



²¹Cathala, C., prepared by the author for the purpose of that article.

²²Cathala, C., prepared by the author for the purpose of that article.

Source: prepared by the author

Finally, the correlation is checked mathematically.

$R_{\text{net result, GDP}} = 0.641$.

For Germany, all of those 3 tests confirm the strong positive correlation between the change in firms' net result and change in the GDP.

2. Spain

As discussed above, the below correlation table per year shows that in 10 cases over 16 cases, the trend is the same between the change in firm's net result and the GDP. The conclusion confirms the correlation.

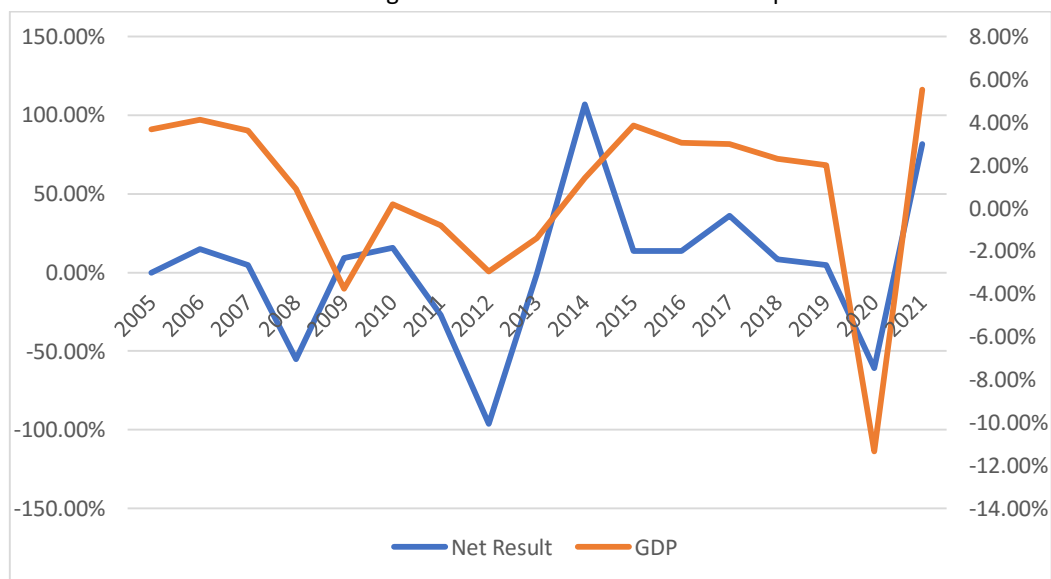
Table 3²³: Correlation table between change in firms' net result and GDP for Spain from 2006 to 2021

NET RESULT	GDP	TREND
Growth	Growth	Same
Growth	Reduction	Different
Loss	Reduction	Same
Growth	Recession	Different
Growth	Growth	Same
Loss	Recession	Same
Loss	Recession	Same
Loss	Recession	Same
Growth	Growth	Same
Growth	Growth	Same
Growth	Reduction	Different
Growth	Reduction	Different
Growth	Reduction	Different
Growth	Reduction	Different
Loss	Recession	Same
Growth	Growth	Same

Source: prepared by the author

The correlation chart is now to be discussed. The slopes is quite the same in both cases confirming the correlation between the 2 set of data.

Table 4²⁴: Correlation chart between change in firms' net result and GDP for Spain from 2005 to 2021



²³Cathala, C., prepared by the author for the purpose of that article.

²⁴Cathala, C., prepared by the author for the purpose of that article.

Source: prepared by the author

Finally, the correlation is checked mathematically.

$R_{\text{net result, GDP}} = 0.570$.

For Spain, all of those 3 tests confirm the strong positive correlation between the change in firms' net result and change in the GDP with a lower strength compared to Germany.

3. Poland

As discussed above, the below correlation table per year shows that in 12 cases over 16 cases, the trend is the same between the change in firm's net result and the GDP. The conclusion confirms the correlation.

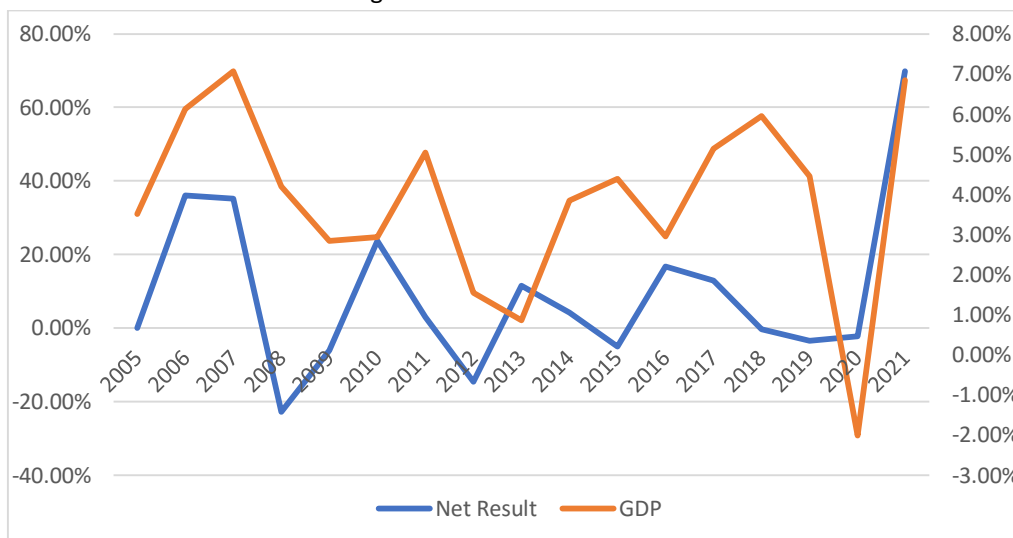
Table 5²⁵: Correlation table between change in firms' net result and the GDP for Poland from 2006 to 2021

NET RESULT	GDP	TREND
Growth	Growth	Same
Growth	Growth	Same
Loss	Reduction	Same
Loss	Reduction	Same
Growth	Growth	Same
Growth	Growth	Same
Loss	Reduction	Same
Growth	Reduction	Different
Growth	Growth	Same
Loss	Growth	Different
Growth	Reduction	Different
Growth	Growth	Same
Loss	Growth	Different
Loss	Reduction	Same
Loss	Recession	Same
Growth	Growth	Same

Source: prepared by the author

The correlation chart is now to be discussed. The slopes is quite the same in both cases confirming the correlation between the 2 set of data.

Table 5²⁶: Correlation chart between change in firms' net result and the GDP for Poland from 2005 to 2021



²⁵Cathala, C., prepared by the author for the purpose of that article.

²⁶Cathala, C., prepared by the author for the purpose of that article.

Source: prepared by the author

Finally, the correlation is checked mathematically.

$R_{\text{net result, GDP}} = 0.479$.

For Poland, all of those 3 tests confirm the positive correlation between the change in firms' net result and change in the GDP with a lower strength compared to Germany and Spain.

▪ **The positive correlation between Wicksell's index and GDP growth**

Now, the focus is made on the relationship between Wicksell's index and the GDP growth.

The correlation test is made between Wicksell's index (the difference between the change in firms' net result and the Long-Term Government Bond Yields: 10-Year) and the GDP change year per year from 2005 to 2021.

For each country, 3 tests are carried out to check the correlation: a correlation table per year, a correlation chart and a mathematical test based on the following formula:

$$r_{i,j} = \text{Cor}(X_i, X_j)$$

1. Germany

As discussed above, the below correlation table per year shows that in 13 cases over 16 cases, the trend is the same between the Wicksell's index and the GDP. For the note, the Wicksell's index shows a growth when the change in firms' net result is higher than the Long-Term Government Bond Yields: 10-Year.

The conclusion confirms the correlation.

Table 6²⁷: Correlation table between Wicksell's index and GDP for Germany from 2006 to 2021

GERMANY	WICKSELL'S INDEX	GDP	TREND
2006	Growth	Growth	Same
2007	Growth	Reduction	Different
2008	Weak	Reduction	Same
2009	Weak	Recession	Same
2010	Growth	Growth	Same
2011	Weak	Reduction	Same
2012	Growth	Reduction	Different
2013	Weak	Growth	Different
2014	Growth	Growth	Same
2015	Weak	Reduction	Same
2016	Growth	Growth	Same
2017	Growth	Growth	Same
2018	Weak	Reduction	Same
2019	Growth	Growth	Same
2020	Weak	Recession	Same
2021	Growth	Growth	Same

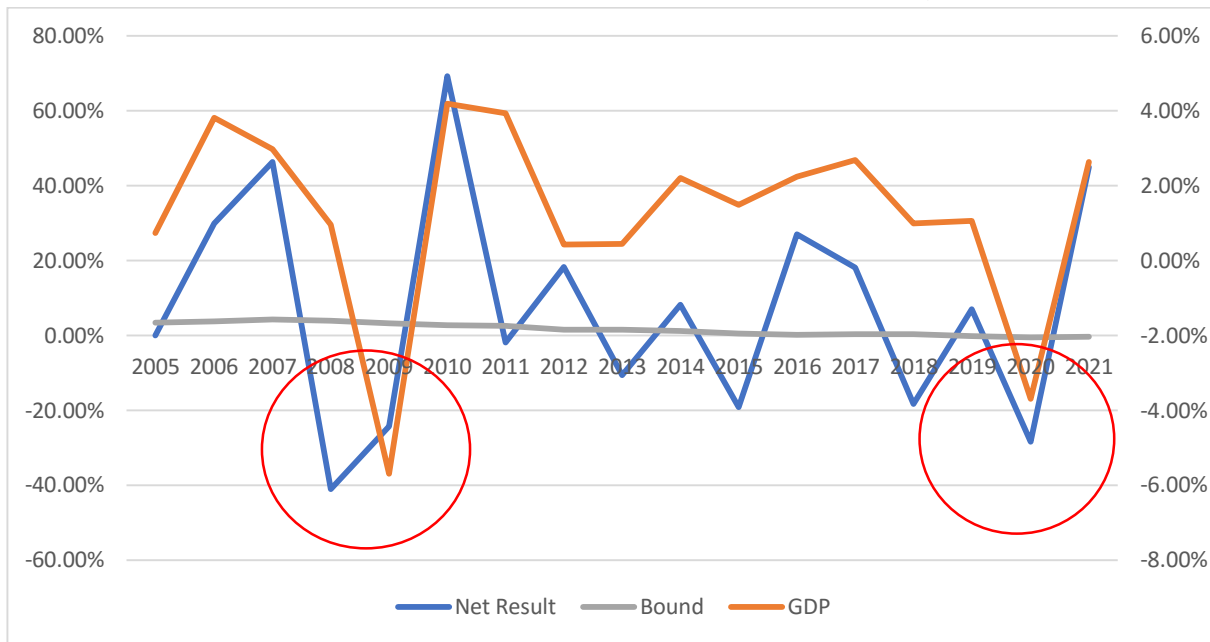
Source: prepared by the author

The correlation chart is now to be discussed.

In both recession cases for Germany, the Wicksell's index is negative.

²⁷Cathala, C., prepared by the author for the purpose of that article.

Table 7²⁸: Correlation chart between Wicksell's index and the GDP for Germany from 2005 to 2021



Source: prepared by the author

Finally, the correlation is checked mathematically.

$R_{\text{net result, GDP}} = 0.636$.

For Germany, all of those 3 tests confirm the strong positive correlation between the Wicksell's index and the change in the GDP.

For recession, in both cases, the Wicksell's index reduced strongly and it was negative.

Finally, looking at the correlation ranking, it appears that recession's cases have the higher grades.

Table 8²⁹: Recession's ranking for Germany from 2006 to 2021

	NET RESULT	WICKSELL'S INDEX	GDP	GRADES	RANKING	
2006	4	5	3	12	13	
2007	2	3	4	9	15	
2008	16	16	12	44	2	
2009	14	14	16	44	2	Recession
2010	1	1	1	3	16	
2011	10	10	2	22	10	
2012	6	7	14	27	7	
2013	11	11	13	35	4	
2014	8	9	8	25	9	
2015	13	13	9	35	4	
2016	5	4	7	16	12	
2017	7	6	5	18	11	
2018	12	12	11	35	4	
2019	9	8	10	27	7	
2020	15	15	15	45	1	Recession
2021	3	2	6	11	14	

²⁸Cathala, C., prepared by the author for the purpose of that article.

²⁹Cathala, C., prepared by the author for the purpose of that article.

Source: prepared by the author

2. Spain

As discussed above, the below correlation table per year shows that in 10 cases over 16 cases, the trend is the same between the Wicksell's index and the GDP. For a note, the Wicksell's index shows a growth when the change in firms' net result is higher than the Long-Term Government Bond Yields: 10-Year.

The conclusion confirms the correlation.

Table 9³⁰: Correlation table between Wicksell's index and the GDP for Spain from 2006 to 2021

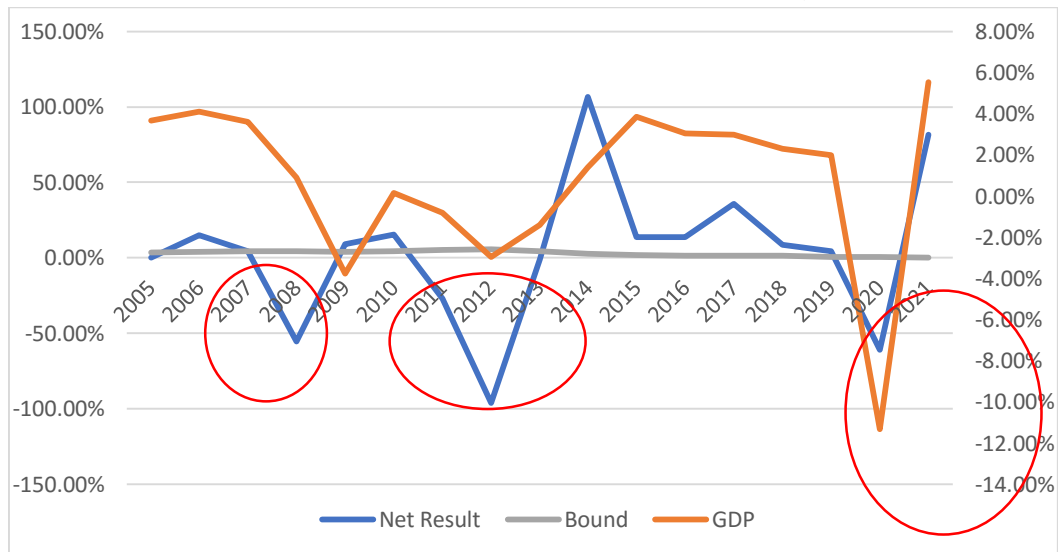
SPAIN	WICKSELL'S INDEX	GDP	TREND
2006	Growth	Growth	Same
2007	Growth	Reduction	Different
2008	Weak	Reduction	Same
2009	Growth	Recession	Different
2010	Growth	Growth	Same
2011	Weak	Recession	Same
2012	Weak	Recession	Same
2013	Weak	Recession	Same
2014	Growth	Growth	Same
2015	Growth	Growth	Same
2016	Growth	Reduction	Different
2017	Growth	Reduction	Different
2018	Growth	Reduction	Different
2019	Growth	Reduction	Different
2020	Weak	Recession	Same
2021	Growth	Growth	Same

Source: prepared by the author

The correlation chart is now to be discussed.

Spain shows 5 cases of recession. In fourth case, the Wicksell's index is negative. In one case, 2008-2009, the effect appeared to be the first for firms (Wicksell's index negative) in 2008 followed by a recession in 2009 (but Wicksell's index has recovered that year).

Table 10³¹: Correlation chart between Wicksell's index and the GDP for Spain from 2005 to 2021



Source: prepared by the author

³⁰Cathala, C., prepared by the author for the purpose of that article.

³¹Cathala, C., prepared by the author for the purpose of that article.

Finally, the correlation is checked mathematically.

$R_{\text{net result, GDP}} = 0.565$.

For Spain, all of those 3 tests confirm the strong positive correlation between the Wicksell's index and the change in the GDP. For recession, in 4 cases over 5, the Wicksell's index reduced strongly and it was negative and in one case, it was one year before the recession.

Finally, looking at the inflation ranking, it appears that recession's cases have the higher grades.

Table 11³²: Recession's ranking for Spain from 2006 to 2021

	NET RESULT	WICKSELL'S INDEX	GDP	GRADES	RANKING	
2005						
2006	5	7	2	14	12	
2007	11	11	4	26	8	
2008	13	13	10	36	4	
2009	8	9	15	32	6	Recession
2010	4	6	11	21	10	
2011	12	12	12	36	4	Recession
2012	15	15	14	44	2	Recession
2013	16	16	13	45	1	Recession
2014	1	1	9	11	15	
2015	6	5	3	14	12	
2016	6	4	5	15	11	
2017	3	3	6	12	14	
2018	9	8	7	24	9	
2019	10	10	8	28	7	
2020	14	14	16	44	2	Recession
2021	2	2	1	5	16	

Source: prepared by the author

3. Poland

As discussed above, the correlation table per year below shows that in 11 cases over 16 cases, the trend is the same between the Wicksell's index and the GDP. For a note, the Wicksell's index shows a growth when the change in firms' net result is higher than the Long-Term Government Bond Yields: 10-Year.

The conclusion confirms the correlation.

Table 12³³: Correlation table between Wicksell's index and the GDP for Poland from 2006 to 2021

POLAND	WICKSELL'S INDEX	GDP	TREND
2006	Growth	Growth	Same
2007	Growth	Growth	Same
2008	Weak	Reduction	Same
2009	Weak	Reduction	Same
2010	Growth	Growth	Same
2011	Weak	Growth	Different
2012	Weak	Reduction	Same
2013	Growth	Reduction	Different
2014	Growth	Growth	Same
2015	Weak	Growth	Different
2016	Growth	Reduction	Different
2017	Growth	Growth	Same
2018	Weak	Growth	Different
2019	Weak	Reduction	Same
2020	Weak	Recession	Same
2021	Growth	Growth	Same

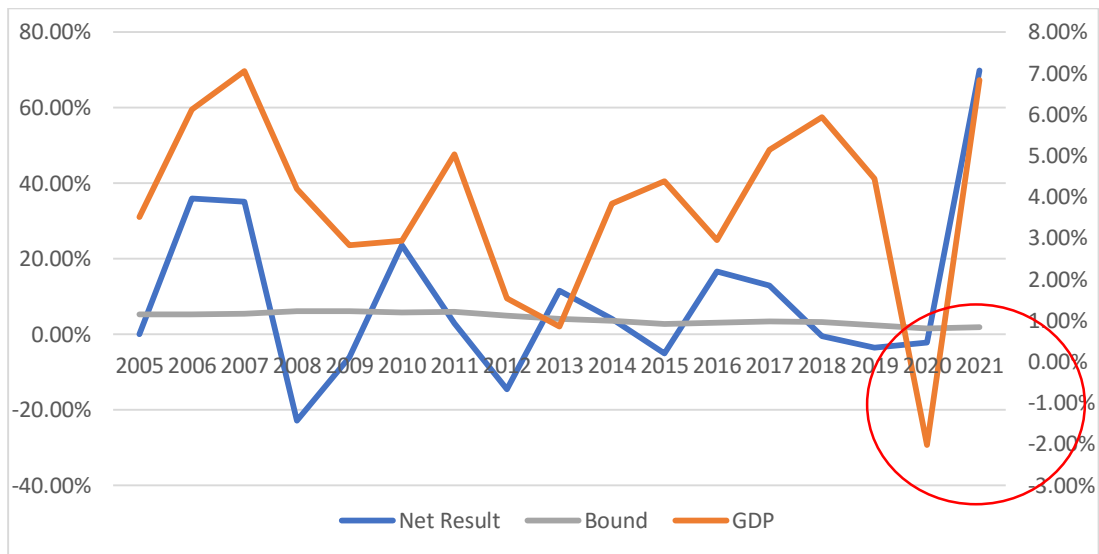
³²Cathala, C., prepared by the author for the purpose of that article.

³³Cathala, C., prepared by the author for the purpose of that article.

Source: prepared by the author

The correlation chart is now to be discussed. There is 1 case of recession in Poland. In such a case, the Wicksell's index is negative.

Table 13³⁴: Correlation chart between Wicksell's index and the GDP for Poland from 2005 to 2021



Source: prepared by the author

Finally, the correlation is checked mathematically.

$$R_{\text{net result, GDP}} = 0.460.$$

For Poland, all of those 3 tests confirm the positive correlation between the Wicksell's index and the change in the GDP. For recession, just one case was experienced and the Wicksell's index was negative.

In terms of ranking, the recession case is not the first one. However, as mentioned above, the correlation exists between the lowest GDP and the lowest Wicksell's index.

Table 14³⁵: Recession's ranking for Poland from 2006 to 2021

	NET RESULT	WICKSELL'S INDEX	GDP	GRADES	RANKING	
2005						
2006	2	2	3	7	14	
2007	3	3	1	7	14	
2008	16	16	9	41	2	
2009	14	14	13	41	2	
2010	4	4	12	20	12	
2011	9	9	6	24	9	
2012	15	15	14	44	1	
2013	7	7	15	29	7	
2014	8	8	10	26	8	
2015	13	13	8	34	5	
2016	5	5	11	21	11	
2017	6	6	5	17	13	
2018	10	10	4	24	9	
2019	12	12	7	31	6	
2020	11	11	16	38	4	Recession
2021	1	1	2	4	16	

³⁴Cathala, C., prepared by the author for the purpose of that article.

³⁵Cathala, C., prepared by the author for the purpose of that article.

Source: prepared by the author

5. Discussion On the Results

As presented previously, based on Wicksell's view, a market interest rate that equals to its natural counterpart guarantees economic stability. A recession should occur once the disbalance is observed. It is the hypothesis which is to be checked in the following article.

The verification is positive as the summary table shows below:

Table 10³⁶: Summary table for Germany, Spain and Poland 2005 – 2021

COUNTRIES	RECESSION	CORR. 1	CASE 1	CORR.2	CASE 2
GERMANY	2	0,641	13	0,636	13
SPAIN	5	0,570	10	0,565	10
POLAND	1	0,479	12	0,460	11

Source: prepared by the author

The number of recessions differs strongly between countries.

Correlations 1 and analytic tables 1 show a correlation between the change in firms' net result and the change in the GDP. That confirms the relevance to use the change in firms' net result as the natural rate of growth of the Economy.

Correlations 2 and analytic tables 2 show a correlation between the Wicksell's index and the change in the GDP. It is worth noting that when a recession occurred, each time the Wicksell's index was negative. In just one case, for Spain, an anticipation of a recession may be observed with a proactive negative value of the Wicksell's index. What is also important is that for the Polish economy, the correlation works less. The reason may be related to the fact that the Polish Economy was less "mature" than the German and Spanish ones and during such phase, the Wicksell index works less.

6. Implication and Further Studies

The purpose of the article was to find means to anticipate a recession more quickly and reliably instead of the standard GDP model. The main characteristics of the research method implemented is based on simplicity. Following Wicksell's legacy, an index has been built and tested. It appears that the index is relevant to anticipate a recession or at least a strong GDP decrease. The index works better for more mature countries. The index is interesting as it is based on 2 economic data which is computed quite easily. Each company is able to estimate its net result the month after and the market rate is observed quite instantly.

For the future research, it would be good to test the index with regard to other countries, especially between mature and growing countries and also on a monthly basis to check its precision. Also it could be possible to make it sharper if the index is also associated with the inflation as such economic data plays also a role in the natural rate of growth of the Economy. It could also be a topic for the future research.

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