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DOES TAXONOMY IN BANKING SUPPORT SUSTAINABLE DEVELOPMENT OF POLISH COMPANIES?*

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Abstract. This paper is aimed at studying measures undertaken by financial institutions in the territory of Poland in the scope of adjusting the credit process to assumptions presented in the Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, commonly referred to as Taxonomy. The problem analysis was conducted based on data for companies employing more than nine persons between 2018 and 2021, that is, at the stage before and during the implementation of Taxonomy. In compliance with the obtained results, no distinct correlations were noticed between a change in the value of credits and loans in non-financial entities and changes in the number of entities, the value of revenues and profits in preferred industries, which shows a low level of Taxonomy's implementation in credit procedures. A positive correlation was noted only in the total revenues of industries covered with research with an overall value of credits. Furthermore, turbulence related to the COVID-19 pandemic, which changed the business environment of banks and the image of Polish entrepreneurship, is also crucial. Even though in the described models, the impact of the COVID-19 pandemic on studied relations proved to be statistically insignificant, differences and deviations are visible in each studied area. Introduction of Taxonomy assumptions to banking strategies, although 'unpopular' and lacking in marketing, may effectively support the sustainable development of Polish companies in the long term. The nine groups of entities indicated in Taxonomy constitute the beginning; however, the list will probably be gradually extended and supplemented with other groups, thus creating a synergetic system supporting the achievement of sustainable development objectives. Effective communication of main assumptions of taxonomy and their implementation in other areas of the business environment of Polish companies is also an important issue. Furthermore, they can be used to develop a better-oriented economic policy supporting green finance, favouring the establishment of green and sustainable entrepreneurship.

Keywords: taxonomy; sustainable development; green finance; banking; entrepreneurship

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1. Introduction

The idea of sustainable development encourages contemporary communities to reflect on the correlations between business, people and understanding of ecosystems and technological aspects as integral parts shaping the image of the contemporary world (Allen et al., 2019). Sustainable development refers not only to issues concerning monitoring and controlling the impact on the environment of various types of organizational practices, processes and products but is also related to protecting the wealth of global natural resources to equally ensure its accessibility for future generations (Docherty et al., 2008; Capasso et al., 2019; Chehabeddine et al., 2022). In the literature, the necessity to verify and extend the approach to sustainable development in management and business education is more and more often indicated, especially in the scope of identification and security of complex relations between communities and organizations and the natural environment (Sherman, Hansen, 2010; Coleman, 2013; Kurucz et al., 2014; Setó-Pamies, Papaoikonomou, 2016). Green growth can be implemented by increasing expenditures on research and development and innovation processes (Lin, Zhu, 2019), engagement of funds in sustainable activity (Mohamed et al., 2014), and introducing grants and tax incentives (Chang et al., 2020), creating conditions favouring long-term green investment (Guo et al., 2018; Adeel-Farooq et al., 2018), creating the green financial system (Zhang, Wang, 2019; Nassar, Strielkowski, 2022), including growing the green bonds market (Ngwenya, Simatele, 2020). One of the manners of supporting sustainable development constitutes the introduction of preferential terms and conditions of crediting for companies meeting criteria stipulated in the Regulation (EU) 2020/852 of the European Parliament and the Council on the establishment of a framework to facilitate sustainable investment, commonly referred to as Taxonomy. Taxonomy defines detailed parameters of classification of economic activity in terms of impact on adaptation to climate changes, or limitation of formation of these changes and allows uniform standardization of assessment of economic activity as environmentally sustainable. Among the main objectives of Taxonomy's implementation, the following ones should be specially indicated: limiting climate changes, adapting enterprises to climate changes, protection of water and marine resources, transition to a circular economy, pollution prevention and control, as well as protection and restoration of biodiversity of ecosystems. Addressees of provisions included in the aforementioned Regulation are, primarily: regulatory authorities of member states obliged to establish instruments and provisions necessary for the implementation of Taxonomy, companies operating in industries indicated in Taxonomy and financial market entities offering financial products and services defined as sustainable. Therefore, Taxonomy is a kind of a map facilitating navigation on the path to sustainable financing of the economy so that selected groups of enterprises direct their investment to sustainable, low-emission industries favourable to climate protection and biodiversity (Kotecki 2020). Support in the scope of sustainable development of enterprises is executed by constructing mechanisms of preferential financing of green investments (Mazzanti, 2018). Financial market entities have been obliged to include preferential financing terms and conditions in their business strategies for companies that meet the assumptions implemented by technical qualification criteria. This paper discusses whether, in the period of adaptation and introduction of Taxonomy into Polish banking, a significant trend concerning the gradual implementation of preferential terms and conditions of crediting for companies operating in sustainable industries has been noted. As a measure of implementation of pro-ecological parameters, the total value of credits and loans in non-financial enterprises, in industries indicated in the Regulation, employing 10 and more persons, operating in the territory of Poland in the years 2018 – 2021 (in 2021, the analysis covers first six months of the year), that is, in the period before and during the implementation of Taxonomy, has been adopted. As parameters characterizing the sustainable development of studied entities, the value of revenues and profit and the size of companies in particular groups have been adopted. Implementing Taxonomy assumptions in banking requires activating a series of pilot and informative measures, which should be reflected in the growing credit and financial parameters of the studied group of enterprises and the growing number of these entities. An important factor that influenced the implementation of Taxonomy in banking was the pandemic, which forced most financial entities to introduce frequent and unexpected changes to credit strategies. Numerous restrictions in the scope of the possibility of conducting specific forms of activity caused redirecting the attention of banks to the introduction of procedures securing the risk of crediting groups of enterprises at risk of insolvency. During the pandemic,

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companies that belong to industries affected by bans and restrictions in activity faced rejection or difficulties in obtaining credits and loans much more frequently than companies operating in industries in which no restrictions were introduced. This situation was a consequence of avoiding financing entities included in the so-called 'list of COVID PKD', in particular, in the case of the following PKD: hotels, tourists, travel agencies, catering, restaurants, bars, event companies, exhibition companies, concert and entertainment companies, cultural institutions, cinemas, sports, recreation and swimming pools (Kamiński, 2021).

This paper analyses a group of enterprises of five of nine industries indicated in Taxonomy: industrial processing, transport, construction, information and communication, and professional, scientific and technical activity. Industrial processing is a sector responsible for approximately 21% of the European Union's direct emission of greenhouse gases. It is also a critical sector which has to limit greenhouse gas emissions. At the same time, transport consumes one-third of the whole energy in the European Union and is responsible for approximately 23% of the total direct emission of greenhouse gases. Decarbonization of the fleet and transport infrastructure is executed by focusing activities on limiting primary sources of emissions from this sector and simultaneously taking into account the need to apply solutions of lower levels of emissions and developing infrastructure allowing clean mobility. The third analyzed industry - construction and building- consumes 40% of energy and 36% of the EU's carbon dioxide emission. New technological criteria of direct qualification trends of changes in construction to energy-saving and ecological solutions, especially concerning the construction of new buildings, renovations of already existing structures, installations of energy-efficient devices, renewable energy sources and provision of energy services. Companies operating in the group ‘information and communication’ are actively supporting sustainable development of other sectors by providing a series of solutions supporting decision making processes in the scope of limiting emission of greenhouse gases. The last of the studied groups, that is, enterprises operating in the sector ‘research, development and innovations’ support achievement of the assumption of sustainable development mainly by concentrating their activities on creating innovative solutions, processes, technologies and other products in the scope of reduction of greenhouse gases which are ultimately used by other sectors of the economy (EC 2021).

Green economic growth is the future direction (Song et al., 2019), the answer to climate change and ecological collapse, and one of the critical elements in achieving sustainable development (Capsasso et al., 2019). More and more governments have introduced restrictive environmental protection provisions and regulations (Soewarno, Tjahjadi, 2020). However, environmental benefits are often at odds with single business entities' economic efficiency (Pan et al., 2019). Various regions struggle with different developmental and environmental challenges (Guo et al., 2020), and the choice of a policy in the scope of sustainable development objectives remains at the discretion of a given country. In the phase of Taxonomy implementation in Poland, no explicit tendency to redirect the attention of banks and financial institutions to issues related to supporting the sustainable development of industries indicated in Taxonomy was disclosed. Indeed, innovations within green financial products are becoming an important factor of contemporary businesses (Chen, Hung, 2014), building green organizational identity (Chang, Chen, 2013) and achieving competitive advantage as well as SME effectiveness (Lin, Zhu, 2019), however, this is only the beginning of a long and difficult path full of sacrifices and compromises, which will allow modern societies to develop in compliance with seventeen objectives of sustainable development.

2. Theoretical background

Taxonomy is the first document which systematized economic activities by the level of their impact on environmental objectives and sustainable economy. Although it does not block the process of investing in activities detrimental to the environment, it is also a tool that grants additional preferences to the benefit of pro-ecological solutions and initiatives. A lack of standardized provisions defining which investments are recognized as sustainable environment leads to the abuse of 'ecological' marketing by organizations representing their activity

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as environment friendly in a situation when a given activity is not, in fact, sustainable. Provisions included in the Taxonomy document aim to standardize and specify manners of identifying and supporting enterprises operating sustainably. They constitute a group of harmonized European principles, which allow systematic and permanent support of pro-ecological measures undertaken in the European Union (PARP, 2021); they aim to ensure the status of the first climatically neutral continent for Europe until 2050. Taxonomy constitutes a source of new regulations related to sustainable development and financing, and implementation thereof allows directing the flow of capital to economic sectors considering the environmental aspect. It impacts the financial market and the real sphere of the economy (Kotecki, 2020). According to the assumptions presented in the Regulation, economic activity can be considered sustainable if it meets at least four criteria (EC Europa, 2019):

- ensures a significant impact on the implementation of at least one out of six environmental objectives that it affects climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, protection and restoration of biodiversity and ecosystems;
- is characterized by a lack of significant harm' to other environmental objectives, and is compliant with technical criteria;
- is in alignment with minimum safeguards concerning social security and management.

Following technical qualification criteria for defining terms and conditions in compliance with which the economic activity is qualified as making a significant contribution to mitigating climate changes and defining whether this economic activity does not significantly harm other environmental objectives, nine types of economic activity are indicated, for which framework was defined allowing verification of pro-ecological nature of the activity and the use of preferential terms in the scope of financing sustainable development. The aforementioned groups of enterprises include entities operating in the following areas (EC, 2021):

- forestry,
- measures in the scope of environmental protection and rehabilitation,
- industrial processing,
- energy industry,
- water supply, sewage and waste management and remediation,
- transport,
- construction and activity related to real estate,
- information and communication,
- professional, scientific and technical activity.

Taxonomy and technical criteria of qualification can be optionally used by banks and other financial institutions to implement green financing strategy and report on the scope of the so-called green revenues, investment expenditures, sustainable assets and measures (EC Europa, 2019a). Assumptions presented in the Regulation standardize, unify and offer ready-made solutions for financial institutions in the scope of ESG (environmental, social and governance) risk management. Financial institutions are gradually levelling their exposure to this type of risk. On the other hand, the problem of costs of implementing proposed solutions, their maintenance and monitoring, and expenses related to the risk of crediting an innovative pro-ecological solution arise (Zioło, 2020).

It should be remembered that green finance does comprise not only financing environmentally safe measures but also a fundamental change in the way of thinking about finance. Financing public and private green investment and investment aimed at preventing, minimizing and compensating damages suffered by the environment and climate are only some areas defined as green finance. This term also covers financing policies on environment protection and mitigating and adapting to environmental changes, as well as particular financial system elements (Kotecki 2020). Banks, as financial institutions granting loans and credits to companies, play a unique role in estimating the risk and cost of the capital and making decisions on approving or rejecting a transaction. They also

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have a possibility of introducing additional parameters for assessing an entrepreneur, giving preference to environmentally sustainable companies and introducing a negative assessment of transactions in the case of entities and investments, consequences of which may prove socially or environmentally detrimental (Zioło, 2020).

Increasing the effectiveness of banks' activities to benefit sustainable development requires changing business models so that they are primarily based on establishing sustainable value. Exchanging traditional business models for ecological ones is a complex process that banks must prepare in organizational, financial and legal terms (Fisk, 2010). Climate risk should be considered in critical areas of activity of financial institutions, such as business strategy, organizational structure, risk management and disclosures (Kotecki, 2020). Therefore, depending on the adopted business strategy, banks can be an accelerator or a barrier to changes in the direction of sustainable development (Busch et al., 2016). However, it is in commercial banks' interest that their strategies are increasingly specific in legal, economic and institutional terms in compliance with the green finance strategy of redirecting capital to a sustainable economy (Kotecki, 2020). In compliance with research conducted by EY and IIF, until 2019, only every third bank included the impact of climate risk on credit exposures (WEF, 2019). The indicated situation was related to a lack of market standards in the scope of used methodologies and tools for measuring the climate risk, the necessity to introduce changes in the strategy and the situation resulting from the COVID-19 pandemic (Kotecki, 2020). Sustainable banking stabilizes a financial system by permanently searching for a rational balance between particular stakeholders, considering ecological and environmental aspects and creating an environment favouring sustainable entrepreneurship development (Raczkowski, Zioło, 2017). Studies on the effectiveness of traditional and sustainable banks covering, among others, the size of assets and capitals, profitability or incomes of banks, indicate higher effectiveness of activities of sustainable banks (Shah et al., 2019). At the same time, the development of the financial sector favours sustainable economic growth, especially in the long term (Shah et al., 2019; Durusu-Ciftci, 2017). Environmental issues have been regulated in banking provisions to ensure the concurrent development of financial and non-financial entities. In May 2020, the European Central Bank (ECB) started consultations on the scope of taking into account the climate risk by financial institutions. ECB's expectations concerned, among others:

- taking the climate risk into account in the business strategy and risk management system,
- monitoring and reporting climate risk exposure,
- quantification of the impact of climate risk on monitored types of risk (primarily credit, market, liquidity and operational),
- estimation of the climate risk impact on capital adequacy,
- taking the climate risk into consideration at all stages of the credit process, valuation of securities and monitoring risk in the credit portfolio,
- development of scenarios taking into account climate risk for stress tests,
- taking climate risk into account in the liquidity risk management and calibration of liquidity buffers,
- disclosing important information and measures related to climate risk.

The above requirements aim to verify the resistance of banks' business models, estimate the level of incurred risk, and verify how climate risk influences the institution's capital position (Kotecki, 2020). At the end of May 2020, EBA completed guidelines for granting and monitoring credit facilities implementing the ESG agenda in the credit process. The guidelines indicate, among others, that financial institutions should assess the exposure of a borrower to ESG factors, especially related to climate risk and environmental threats (EBA, 2020). Whereas, Taxonomy is a document indicating the three most essential obligations of entities from the financial industry concerning transparency of offered products, in compliance with which (EC, 2021):

1) in the case of financial products used in investment in economic activity contributing to the achievement of an environmental objective, the entrepreneur applying for funding must disclose information about the purpose of investment and a detailed description of how and to what extent a given investment will be implemented within environmentally sustainable economic activity,

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2) suppose a financial product promotes an environmental aspect. In that case, meeting the terms and conditions included in point one is necessary. Additionally, the following statement must be attached to the application: *'The principle 'do not cause severe damage' applies only to investments executed within the financial product, which consider the European Union criteria concerning environmentally sustainable economic activity.'*
3) The following statement should be attached concerning other financial products: *'Investments within this financial product do not consider the European Union criteria concerning environmentally sustainable economic activity.'*

A lack of limited access to funds for companies that do not consider environmental aspects increase industrial activity, leading to further degradation of the environment and rising carbon dioxide emissions (Sadorsky, 2010; Shahbaz, 2015). Therefore, the financial sector should pursue funding and invest in environmentally friendly technologies and ventures aimed at limiting excessive use of natural resources (Yahya, 2022), as well as supporting the development of sustainable sectors.

3. Methodology

The assessment of taxonomy in credits and loans in selected industries is complex due to the short time series. For this analysis panel models were used. These models allowed the relationship assessment even though the time series are very short. With a cross-sectional time series, including 4-year data for five sections: (1) industrial processing, (2) transport, (3) construction and real estate activities, (4) information and communication, as well as (5) professional, scientific and technical activities, it was possible to evaluate the importance of taxonomy in credits and loans. Apart from panel models, basic measures of the structure and dynamics of phenomena were used.

Panel models may take the form of: models with decomposition of the intercept (FEM - fixed effects model) or models with random component decomposition (REM – random effects model). The FEM and REM models can generally be written as follows:

$$y_{it} = m_i + bx_{it} + e_{it}$$

where:
m_i - general intercept,
b - structural parameter expressing the influence of the explanatory variable X,
x_{it} - realization of the explanatory variable for the i-th object in the t-th period,
e_{it} - classical scene representation: $E(e_{it}) = 0$ and $Var(e_{it}) = E(e_{it}) = 0$ i $Var(e_{it}) = S_e^2$.

In the FEM model m_i is decomposed into intercepts (constants) for individual groups. The model has the form (Suchecki, Antczak 2012):

$$y_{it} = a_1 d_{1it} + a_2 d_{2it} + ... + a_k d_{kit} + bx_{it} + e_{it} = a_i + bx_{it} + e_{it}$$

where:
a_i - specific intercepts,
d_i - zero-one variables, with value 1 when j = i.

In the REM model m_i expresses random components. This model can be written (Greene 2008, p. 388):

$$y_{it} = a + bx_{it} + e_{it} + u_i,$$

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where:
$E(u_i) = 0$, $Var(u_i) =$, $Cov(e_{it}, u_i) = 0$

When analyzing the one-factor model (with group effects), the significance of the individual effects should be checked using the Wald test. The zero hypothesis assumes that the conditions imposed on the model ($\alpha\_1=\alpha\_2=\cdots=\alpha\_N=\mu$) are the rules of the model and that model estimation should take place without individual effects. If $p < \alpha$, the zero hypothesis is rejected for an alternative hypothesis, - individual effects appear. The validity of introducing individual effects into the model with random effects is verified by examining whether the variance of the random component is different from zero. The zero variance indicates the lack of variation of the individual component and its constant value for all test objects, which makes it possible to replace it with a common intercept. The LM test statistic is used to verify the hypotheses of the Breusch-Pagan test. If the test statistic converges to the distribution χ^2 (1), then there is no reason to reject the zero hypothesis. If, on the other hand, the value of the test statistic exceeds the critical value, it is rejected, which suggests the significance of individual effects in the model with random effects (Witkowski, 2012).

Suppose all the assumptions for the models with fixed effects and models with random effects are met. In that case, deciding which model is better suited to the analyzed phenomenon is necessary. For this purpose, the Hausman test is performed, determining the nature of the specific effects. It examines the correlation between explanatory variables and random effects (Czyżewska, Staniszewski, 2016). A p value below the set limit level means that the model with fixed effects (with decomposition of the intercept) is better. The zero hypothesis says that the assumption about the independence of exogenous variables from individual effects is met, and the estimator of random effects is more effective. Rejecting the zero hypothesis means that the fixed effects estimator is unbiased and more efficient than the random effects estimator (Czyżewska, Staniszewski, 2016). Panel models were estimated with the use of the Gretl program. MS Excel and IBM SPSS Stastics 25.0 were used for the remaining analyzes.

4. Results and Discussion

The implementation process of assumptions included in Taxonomy is related to the necessity of undertaking a series of measures in the scope of adjusting strategy, provisions and parameters of the credit process of sustainable economic activity by Polish banks. Given the time that has passed since publishing the *Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment* until activating provisions included therein (18 June 2020 - 1 January 2022), banks and other financial institutions had almost two years to adjust procedures to the requirements of the Regulation. Work on the implementation of the new ecological approach in banking requires a lot of preliminary and preparatory work, which, in consequence, should be reflected in the growing number of companies and an increase in revenues, profits and credits in the case of entities acting in preferred industries.
In the years 2018-2021, non-financial entities for five studied sections, which in compliance with the *Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment* are covered with Taxonomy, constituted slightly over a half of the total number of enterprises employing at least 10 persons (table no. 1). This percentage remained at a similar level in the whole period – at the end of 2018 these entities constituted 53.1%, and at the end of the 1st half of 2021 – 53.7%. This share in each studied year was similar at the end of the 1st and the 2nd half a year. Whereas the number of entities operating at the end of December was by approx. 3 thousand higher than at the end of June – at the end of the 1st half of a year it amounted to 22.8-23.9 thousand, while at the end of the year – 26.5-26.9 thousand.

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Table no. 1. Non-financial entities registered in Poland employing 10 persons or more – in total and covered with Taxonomy, in the years 2018-2021 (status at the end of June and December)

Specification	2018		2019		2020		2021
	6	12	6	12	6	12	6
Number of enterprises							
IN TOTAL	45,177	50,013	44,676	50,158	43,886	49,485	42,465
including those covered with Taxonomy, in total	23,931	26,553	23,747	26,878	23,473	26,660	22,819
Industrial processing	13,012	13,975	12,672	13,987	12,394	13,734	12,049
Construction	4,233	4,760	4,108	4,807	4,048	4,881	3,942
Transport and warehouse management	2,673	3,097	2,644	3,161	2,647	3,088	2,524
Information and communication	1,653	1,982	1,804	2,071	1,841	2,090	1,851
Professional, scientific activity	2,360	2,739	2,519	2,852	2,543	2,867	2,453
in % (in total = 100)							
Covered with Taxonomy, in total	53.0	53.1	53.2	53.6	53.5	53.9	53.7
Industrial processing	28.8	27.9	28.4	27.9	28.2	27.8	28.4
Construction	9.4	9.5	9.2	9.6	9.2	9.9	9.3
Transport and warehouse management	5.9	6.2	5.9	6.3	6.0	6.2	5.9
Information and communication	3.7	4.0	4.0	4.1	4.2	4.2	4.4
Professional, scientific activity	5.2	5.5	5.6	5.7	5.8	5.8	5.8

Source: Financial results of business entities, Statistics Poland, Warsaw.

Over half of the entities covered with Taxonomy are non-financial enterprises representing industrial processing – their number in the studied periods approximated 12-14 thousand. While comparing the status at the end of a given half a year, changes in the number of entities in particular sections were small (apart from a few cases, they did not exceed 5% with regard to a previous analogous period, only for the information and communication section, at the end of the 1st half of 2019 the number of entities increased by 9%, and in the professional and scientific activity section – by 7%). Therefore, the pandemic period did not bring drastic changes in their case. However, it should be underlined that similarly to the total number of non-financial enterprises employing over 9 employees, also in sections covered with Taxonomy (in total), a small drop in the number of entities was noted. The upward trend also continued in the years 2020-2021 in the information and communication section and in 2020 in transport and warehouse management as well as a professional and scientific activity.

In the studied period, a decrease in revenues of non-financial entities was noted at the beginning of the COVID-19 pandemic – in the 1st half of 2020, compared with the 1st half of 2019, the total number of entities dropped by 5%. This decrease in entities covered with Taxonomy was even more significant – it reached 6%. This situation was different in different sections – while in the industrial processing revenues decreased by 8.7% and in transport and warehouse management – by 3.4%, in construction they increased by 3.7%, in information and communication – it increased by 4.2%, and in professional and scientific activity – it increased by 2.6%. Another year brought a significant improvement of the situation in this scope for non-financial enterprises in total (an increase of 18.6% in comparison with the 1st half of 2020 and by 12.4% in the 1st half of 2019), analogous increases (by 20.1% and 12.7%, respectively) concerning entities covered by Taxonomy. The strongest growth was noted in the case of revenues of companies from the industrial processing section (by 22.8% in comparison to the 1st half of 2020 and 12.1% for 2019), information and communication (by 18.3% and 23.3%, respectively) as well as Transport and warehouse management (17.2% and 13.2%, respectively). Per capita the most robust growth (1st half of 2021 vs 2020) concerned industrial processing (23.5%) and transport and warehouse management (22.9%). Revenues of enterprises covered with Taxonomy constituted slightly over half of revenues generated by non-financial entities, and this share was stable over time. Their value in the 1st half of a year reached on average approx. PLN 900

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milliard, and in 2021 it exceeded PLN 1 billion. Whereas, at the end of the year it got approx. PLN 1.9 billion, and the year 2020 was no exception in this scope.

Table no. 2. Revenues of non-financial entities registered in Poland employing 10 persons or more – in total and covered with Taxonomy, in the years 2018-2021 (in the period between 1-6 and 1-12)

Specification	2018		2019		2020		2021
	1-6	1-12	1-6	1-12	1-6	1-12	1-6
Revenues (in PLN million)							
IN TOTAL	1,695,798.1	3,645,426.7	1,809,167.7	3,834,527.8	1,714,579.7	3,782,212.2	2,033,287.2
including those covered with Taxonomy, in total	882,555.9	1,898,369.9	929,844.6	1,987,458.7	873,087.1	1,940,653.1	1,048,327.2
Industrial processing	652,177.9	1,355,801.0	682,963.4	1,412,678.9	623,223.7	1,365,911.6	765,353.0
Construction	65,359.0	175,537.7	67,942.9	176,207.9	70,440.6	174,942.0	73,352.9
Transport and warehouse management	78,623.7	175,537.7	85,341.9	190,185.2	82,461.2	183,916.5	96,615.5
Information and communication	54,677.6	121,409.0	59,430.4	129,069.9	61,906.8	135,409.9	73,261.6
Professional and scientific activity	31,717.7	70,084.5	34,166.0	79,316.8	35,054.8	80,473.1	39,744.2
% (in total = 100)							
Covered with Taxonomy, in total	52.0	52.1	51.4	51.8	50.9	51.3	51.6
Industrial processing	38.5	37.2	37.8	36.8	36.3	36.1	37.6
Construction	3.9	4.8	3.8	4.6	4.1	4.6	3.6
Transport and warehouse management	4.6	4.8	4.7	5.0	4.8	4.9	4.8
Information and communication	3.2	3.3	3.3	3.4	3.6	3.6	3.6
Professional and scientific activity	1.9	1.9	1.9	2.1	2.0	2.1	2.0
Revenues per enterprise (in PLN billion)							
IN TOTAL	37.54	72.89	40.50	76.45	39.07	76.43	47.88
including those covered with Taxonomy, in total	36.88	71.49	39.16	73.94	37.20	72.79	45.94
Industrial processing	50.12	97.02	53.90	101.00	50.28	99.45	63.52
Construction	15.44	36.88	16.54	36.66	17.40	35.84	18.61
Transport and warehouse management	29.41	56.68	32.28	60.17	31.15	59.56	38.28
Information and communication	33.08	61.26	32.94	62.32	33.63	64.79	39.58
Professional and scientific activity	13.44	25.59	13.56	27.81	13.78	28.07	16.20

Source: Financial results of business entities, Statistics Poland, Warsaw.

The year 2021 was exceptional in terms of the gross financial result of non-financial enterprises – in the 1st half of 2021, it reached over PLN 142 milliard, whereas, in the 1st half of 2020, it was lower by a half (approx. PLN 76 milliard), whereas, in the previous years it reached approx. PLN 90 milliard (table no. 3). At the end of 2020, the financial result of non-financial entities was slightly higher than for 1-12.2021 (approx. PLN 163 milliard). Entities from sections covered with Taxonomy generated the gross financial result constituting approx. 2/3 of entities in total – at the end of 2018 and 2019, it was 66.4-67.7%, in the 1st half of 2021 – 60.5%, a year earlier – 52.5%. In the 1st half of 2020, they noted a higher decrease than non-financial entities in total – it reached 28%, whereas a 66 per cent drop was recorded in transport, in industrial processing – 34%, in professional and scientific activity – 23%, while information and communication noted a 16 per cent increase and construction – 13 per cent.

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Table no. 3. Gross financial result of non-financial entities registered in Poland employing 10 persons or more – in total and covered with Taxonomy, in the years 2018-2021 (in the period between January and June, and June and December)

Specification	2018		2019		2020		2021
	1-6	1-12	1-6	1-12	1-6	1-12	1-6
Gross financial result (in PLN million)							
IN TOTAL	87,717.0	167,942.5	91,815.1	164,377.4	76,163.6	163,433.1	142,421.7
including those covered with Taxonomy, in total	51,968.1	111,521.9	55,209.1	111,332.5	39,980.8	103,534.4	86,147.2
Industrial processing	39,147.7	73,804.0	39,211.7	73,309.9	25,848.8	66,380.0	56,736.8
Construction	2,582.7	18,307.1	3,521.0	10,963.3	3,986.4	11,581.4	5,502.6
Transport and warehouse management	3,674.7	7,744.2	4,067.3	8,615.1	1,376.6	4,511.0	5,146.7
Information and communication	3,865.4	6,965.5	5,067.3	11,802.2	5,857.1	13,796.6	13,874.2
Professional and scientific activity	2,697.6	4,701.1	3,341.8	6,642.0	2,911.9	7,265.4	4,886.9
% (in total = 100)							
covered with Taxonomy, in total	59.2	66.4	60.1	67.7	52.5	63.3	60.5
Industrial processing	44.6	43.9	42.7	44.6	33.9	40.6	39.8
Construction	2.9	10.9	3.8	6.7	5.2	7.1	3.9
Transport and warehouse management	4.2	4.6	4.4	5.2	1.8	2.8	3.6
Information and communication	4.4	4.1	5.5	7.2	7.7	8.4	9.7
Professional and scientific activity	3.1	2.8	3.6	4.0	3.8	4.4	3.4
Gross financial result per enterprise (in PLN million)							
IN TOTAL	1.94	3.36	2.06	3.28	1.74	3.30	3.35
including those covered with Taxonomy, in total	2.17	4.20	2.32	4.14	1.70	3.88	3.78
Industrial processing	3.01	5.28	3.09	5.24	2.09	4.83	4.71
Construction	0.61	3.85	0.86	2.28	0.98	2.37	1.40
Transport and warehouse management	1.37	2.50	1.54	2.73	0.52	1.46	2.04
Information and communication	2.34	3.51	2.81	5.70	3.18	6.60	7.50
Professional and scientific activity	1.14	1.72	1.33	2.33	1.15	2.53	1.99

Source: Financial results of business entities, Statistics Poland, Warsaw.

Furthermore, for the whole year of 2020, a decrease in the gross financial result in sections covered with Taxonomy (7%) was higher than in financial entities in total (0.6%), and in transport amounted to almost half (47.6%). In industrial processing for the whole year, a decrease in the gross financial result was also noted – by 9.5%. Whereas, in the information and communication section in 2020 an increase was noted in comparison to 2019 – by 16.9%, however, in the previous year this increase reached 69%. Similarly, an upward trend was noted by the professional and scientific activity section (an increase by almost 10% in 2020 and by 41% in 2019). Construction reported an increase of 5.6%, although it 'started' from a low level and did not recover its position from 2018 when the gross profit reached in the whole industry approx. PLN 18 milliard, and per capita – PLN 3.85 million. Calculated per enterprise, in the 1st half of 2021, companies from the information and communication section are explicitly distinct (PLN 7.5 million), and this result is higher than at the end of 2020 (PLN 6.6 million) and approximately thrice as high as in the 1st half of 2018 and 2019.

Moreover, a high profit was noted per industrial enterprise (PLN 4.71 million per capita in the 1st half of 2021, 4.83 at the end of 2020, although this result remains lower than in previous years). Transport has been recovering – in the 1st half of 2021, the gross profit reached PLN 2 million per capita, which is four times more than in the previous year. The year 2021 brought a significant improvement in the financial result in the whole economy, including also enterprises covered with Taxonomy (table no. 3) – in comparison with the 1st half of 2020 this

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increase more than doubled, and in the information and communication – it increased almost 2.5 times (in comparison with the 1st half of 2019 the increase was the highest, it was almost thrice as high). Due to the significant decrease in the gross financial result in transport, in the 1st half of 2021, this increase was the strongest – it was almost 4 times higher. However, compared with the analogous period of 2019, it reached 27%. Only construction and professional and scientific activity generated an increase lower than average in the sector of non-financial enterprises (however, their situation also improved in the 1st half of 2021 both in comparison with the analogous period of the previous year and in 2019). The value of liabilities of non-financial entities in total remains at a similar level in the studied period of time – approx. PLN 500 milliard, whereas at the end of the 1st half of 2018, it reached approx. PLN 450 milliard, in next 12 months – approx. PLN 480 milliard, and as of the end of 2019, it exceeded PLN 500 milliard (maximum for December 2020 – PLN 539 milliard) (table no. 4).

Table no. 4. Long-term and short-term credits and loans in non-financial entities registered in Poland employing 10 persons or more – in total and covered with Taxonomy, in the years 2018-2021 (status at the end of June and December)

Specification	2018		2019		2020		2021
	6	12	6	12	6	12	6
The total value of loans and credits (in PLN million)							
IN TOTAL	459,386.4	482,108.8	482,132.5	515,106.0	524,588.6	538,736.3	513,218.6
including those covered with Taxonomy, in total	256,636.6	262,859.3	260,613.5	273,737.4	285,022.7	286,641.2	262,929.8
Industrial processing	148,780.8	157,645.1	161,973.1	167,922.9	178,878.9	178,134.9	169,421.0
Construction	18,531.7	13,613.4	18,241.4	15,388.5	14,281.2	14,562.6	13,159.0
Transport and warehouse management	31,090.8	32,167.7	26,923.8	32,966.1	38,128.3	39,397.3	40,139.9
Information and communication	44,055.9	41,490.9	36,106.6	39,714.8	36,577.7	36,104.6	27,281.8
Professional and scientific activity	14,177.4	17,942.2	17,368.6	17,745.1	17,156.6	18,441.8	12,928.1
% (in total = 100)							
Covered with Taxonomy, in total	55.9	54.5	54.1	53.1	54.3	53.2	51.2
Industrial processing	32.4	32.7	33.6	32.6	34.1	33.1	33.0
Construction	4.0	2.8	3.8	3.0	2.7	2.7	2.6
Transport and warehouse management	6.8	6.7	5.6	6.4	7.3	7.3	7.8
Information and communication	9.6	8.6	7.5	7.7	7.0	6.7	5.3
Professional and scientific activity	3.1	3.7	3.6	3.4	3.3	3.4	2.5
Value of loans and credits per enterprise (in PLN million)							
IN TOTAL	10.17	9.64	10.79	10.27	11.95	10.89	12.09
including those covered with Taxonomy, in total	10.72	9.90	10.97	10.18	12.14	10.75	11.52
Industrial processing	11.43	11.28	12.78	12.01	14.43	12.97	14.06
Construction	4.38	2.86	4.44	3.20	3.53	2.98	3.34
Transport and warehouse management	11.63	10.39	10.18	10.43	14.40	12.76	15.90
Information and communication	26.65	20.93	20.01	19.18	19.87	17.27	14.74
Professional and scientific activity	6.01	6.55	6.90	6.22	6.75	6.43	5.27

Source: Financial results of business entities, Statistics Poland, Warsaw.

Enterprises from sections covered with Taxonomy declared related liabilities at a level slightly above half of credits and loans of the total number of non-financial entities employing at least 10 persons; however, this share was somewhat decreasing in consecutive periods (apart from the 1st half of 2021 – 54.3%), and currently is the lowest in the studied period (51.2%). The value of these liabilities in sections covered with Taxonomy at the end of June 2021 reached PLN 263 milliard, and as calculated per enterprise – PLN 11.5 million (that is, it was at a

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similar, slightly lower level than in the previous year). For comparison, in the total number of non-financial companies at the end of the 1st half of 2020 and 2019, the value of credits stayed at a similar level (approx. PLN 12 million), although, in comparison with 2019 an increase by 11% was noted (that is, analogous as for sections covered with Taxonomy). In the 1st half of 2021, in areas covered with Taxonomy in comparison with the identical period in the previous year, generally speaking, a decrease in the value of credits and loans (in total and per capita) was noted, the only exception being transport and warehouse management, where the upward trend also continued in 2021 (an increase by 5% for their general value and 10% per capita), which started in the 1st half of 2020. Whereas, in sections: information and communication and Professional and scientific activity in 2020, the value of credits hardly changed, and in 2021 – it dropped in comparison with the 1st half of 2020 by 20-25% (table no. 4). Figure no. 1 shows that generally speaking, non-financial entities covered with Taxonomy maintained per capita liabilities due to credits and loans at a comparable level (only slightly higher) as for entities in total, whereas, at the end of a year their amount was somewhat lower than in the half of a year, and in the 1st half of 2021 – by approx. 5% higher than for entities in total.

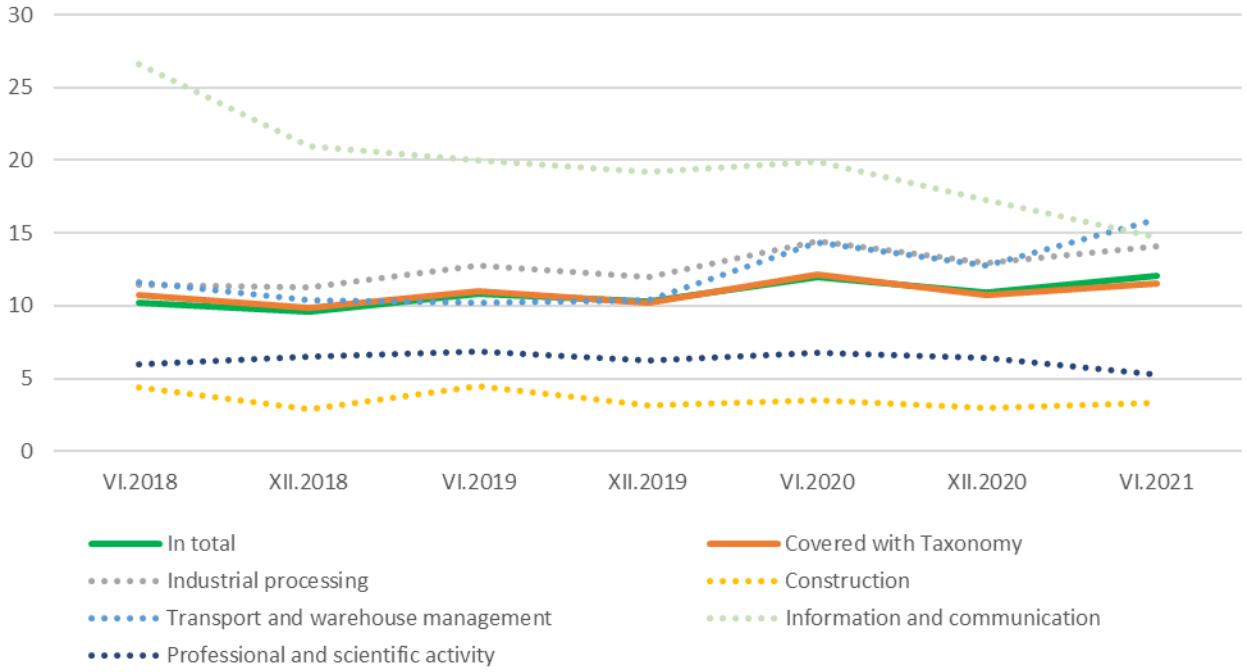

Figure no. 1. The value of credits and loans per enterprise in the years 2018-2021
Source: Financial results of business entities, Statistics Poland, Warsaw.

Credit commitments (per capita) of construction enterprises and enterprises running professional and scientific activity are significantly below average for sections covered with Taxonomy. Their level was relatively stable in the studied period (figure no. 1). Credit commitments in the industry were also slightly above average, yet, at quite a steady level. Whereas in transport and warehouse management, these commitments were until the end of 2019 at an average level, although the pandemic affected this sector – 2020 and 2021 are the years of growing credit commitments. Different trends concern the information and communication section, which in the 1st half of 2018 was the most significantly encumbered with credits and loans – per capita they reached over PLN 25 million; however, at the end of 2018, they decreased to approx. 20 million and at this level, more or less, stayed until the end of the 1st half of 2020, and in the consecutive periods they dropped to approx. PLN 15 million per capita achieved a level similar to transport, warehouse management, and industrial processing.

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By comparing data concerning credits and loans with the financial result of enterprises (figure no. 2) it can be noticed that changes in the value of credits and loans for sections covered with Taxonomy (in total, marked with a continuous line) had weaker correlation with the gross financial result than in the case of a total number of non-financial entities. The COVID-19 pandemic changed regularities in this scope. In the 1st half of 2020 the financial result decreased, while the value of credits and loans increased and at the end of 2020 the situation was opposite (an increase in the gross profit – higher in sections covered with Taxonomy, a decrease in the value of credits). At the end of the 1st half of 2021, the growth rate of profit (for the total number of companies and companies covered with Taxonomy) was higher than in the previous year; however, simultaneously, the value of credits also increased a little, whereas the discrepancy between dynamics of the increase in the financial result and credit commitments was higher in entities covered with Taxonomy than in the total number of non-financial entities (figure no. 2).

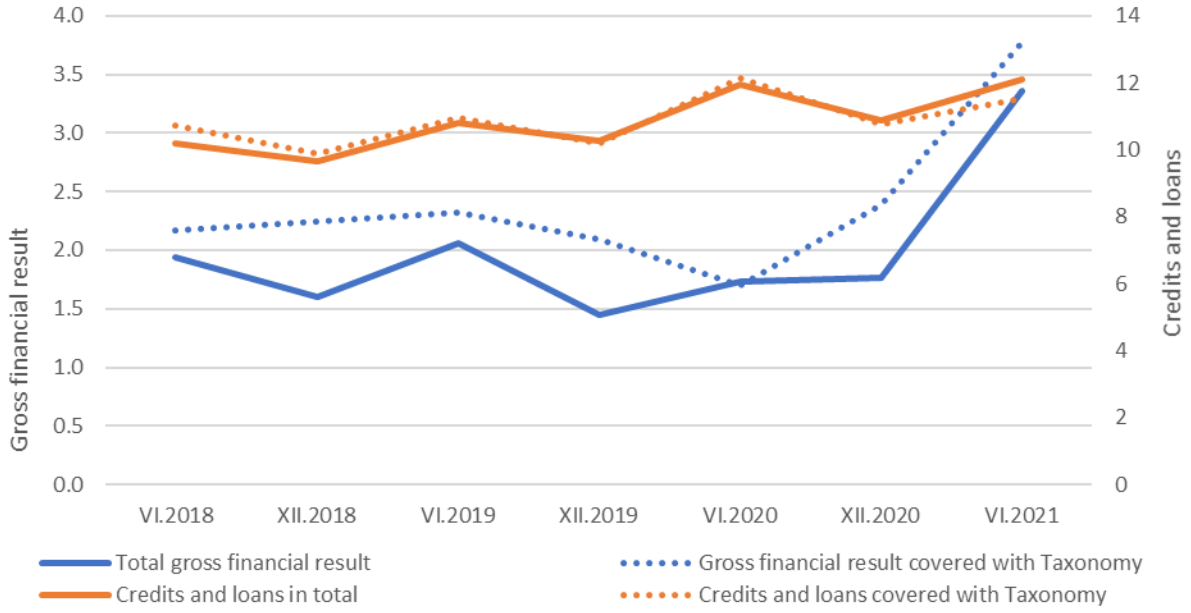

Figure no. 2. The value of credits and loans vs financial result – in total and in sections covered with Taxonomy, in the years 2018-2021 in total (per enterprise)
Source: Financial results of business entities, Statistics Poland, Warsaw.

In particular, in sections covered with Taxonomy, these relations had different courses (figure no. 3). In the case of information and communication as well as professional and scientific activity, the dynamics of the financial result were similar to the values of credits and loans, but the direction of changes was opposite.

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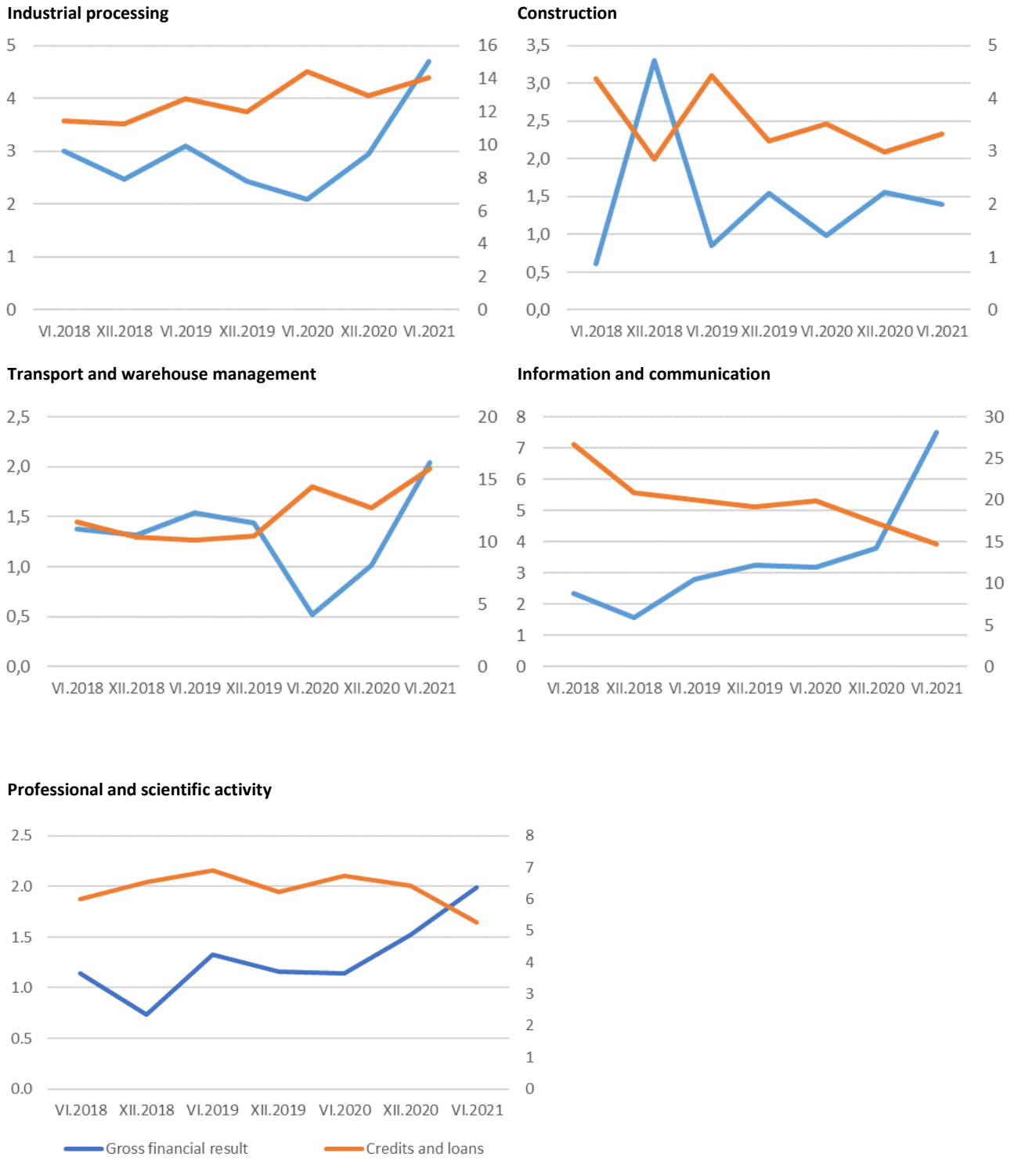

Figure no. 3. The value of credits and loans (right axis) vs financial result (left axis) in particular sections covered with Taxonomy, in total, in the years 2018-2021 (per enterprise)
Source: Financial results of business entities, Statistics Poland, Warsaw.

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Similar, although not that strong, tendencies were noted for the second section. Whereas, in transport, until 2019, both amounts stayed at more or less the same level, while in the 1st half of 2020, the financial result plummeted and credits increased. In consecutive periods the financial result was growing significantly faster than the value of credits and loans. Similar, although not that strong, tendencies were noted for industrial processing. The situation in construction was completely different since at the end of the 1st half of a year, the financial results were significantly lower than at the end of a year, and the value of credits and loans – was higher. These changes were massive at the beginning of the studied period (until June 2019), and these changes were minor. However, the seasonal character is still visible both in the profit value and credit commitments (figure no. 3).

The gross financial result per enterprise (*FinancialResults_pc*) is negatively correlated with the value of credits per capita (B = -0.333; p = 0.0002 – it is higher when the value of credits per capita is lower. Ceteris paribus the gross financial result is on average lower by PLN 0,333 million when the value of credits and loans per enterprise is higher by PLN 1 million (table no. 5). It should be remembered that the model is estimated on the grounds of a time and cross-section trial, and takes into account diversity between sections. The zero-one variable has also been included, taking the value of 1 for the 1st half of a year. Its importance is also statistically significant (B = -1.024; p = 0.0018). The zero-one variable distinguishing pandemic periods has also been included in the model; however, its impact has not proven to be statistically significant.

This model was estimated with a fixed model method (the validity of this choice is confirmed by the results of F-test (p < 0.0001) and Hausman Test (p < 0.0001)). The estimated model explains the variability of the gross financial result at 80.8%.

Table no. 5. Results of per capita financial result model – model 1: *Financial Results_pc = f(Credits_pc)*

	B	*S(B)*	*t*	*p*	
const	6.977	0.838	4.521	<0.0001	***
Credits_pc	-0.333	0.078	-4.259	0.0002	***
U01	-1.024	0.297	-3.450	0.0018	***
LSDV R^2	0.8077				
F-test	F(4; 28) = 16.360; p < 0.0001***				
Joint test on named regressors	F(2; 28) = 20.090; p < 0.0001***				
Hausman Test	χ^2 (1) = 25.333; p < 0.0001***				

B – regression coefficient, S(B) – standard error, t – t-statistics, p – probability in the t test. U01 – binary variable, x = 1 for the 1st half of a year. Estimation method – fixed model.

While discussing the potential of sections covered with Taxonomy (the level of their development), one may also use revenues generated from the entire activity. Total revenues (*Revenues*) are positively correlated with the general value of credits (B = 6.123; p < 0.0001) – ceteris paribus, the total value of credits higher by PLN 1 million is related to total revenues higher on average by PLN 60,123 million (table no. 6). Zero-one variable taking the value of 1 for the 1st half of a year is statistically significant. The zero-one variable distinguishing pandemic periods has also been included in the model; however, its impact has not proven to be statistically significant. This model was estimated with the CLS method (validity of this choice is confirmed by the results of F-test (p = 0.2121)). The estimated model explains the variability of the gross financial result at 87.4%.

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Table no. 6. Results of total revenues model estimation – model 4: *Revenues = f(Credits)*

	B	*S(B)*	*t*	*p*	
const	52370.4	43946.8	1.192	0.2422	
Credits	6.123	0.427	14.350	<0.0001	***
U01	-191807	49199	-3.899	0.0005	***
LSDV R^2	0.8744				
F-test	F(2; 28) = 1.561; p < 0.2121***				
Joint test on named regressors	F(4; 28) = 9.042; p < 0.0009***				
Hausman Test	χ^2 (1) = 1.472; p = 0.2251				

B – regression coefficient, S(B) – standard error, t – t-statistics, p – probability in the t test. U01 – binary variable, x = 1 for the 1st half of a year. Estimation method – Panel CLS.

Analogous models were also constructed for the total gross financial result (table no. 7) and revenues per capita (table no. 8).

Table no. 7. Results of total financial result estimation model – model 2: *Financial Results = f(Credits)*

	B	*S(B)*	*t*	*p*	
const	36597.9	12762.1	2.868	0.0078	***
Credits	-0.270	0.230	-1.176	0.2494	
U01	-10532.6	2585.1	-4.074	0.0003	***
LSDV R^2	0.8947				
F-test	F(4; 28) = 3.158; p < 0.0292***				
Joint test on named regressors	F(2; 28) = 8.477; p < 0.0013***				
Hausman Test	χ^2 (1) = 7.485; p = 0.0062***				

B – regression coefficient, S(B) – standard error, t – t-statistics, p – probability in the t test. U01 – binary variable, x = 1 for the 1st half of a year. Estimation method – fixed model.

Total gross financial result (*Financial Result*) is negatively correlated with the total value of credits (B = -0.270; p = 0.2494); however, this correlation is not statistically significant (table no. 8). Zero-one variable taking the value of 1 for the 1st half of a year is statistically significant. The zero-one variable distinguishing pandemic periods has also been included in the model; however, its impact has not proven to be statistically significant. This model was estimated with the fixed model method (validity of this choice is confirmed by the results of F-test (p = 0.0292) and Hausman Test (p = 0.0062)). The estimated model explains the variability of the gross financial result at 89.5%.

Revenues per enterprise (*Revenues_pc*) are negative, yet, statistically insignificant, correlated with the value of credits per capita (B = -0.059; p = 0.9178 (table no. 7). The zero-one variable taking the value of 1 for the 1st half of a year has also been included. Its importance is statistically significant (B = -26.157; p < 0.0001) – in the 1st half of a year, the gross financial result is, on average by PLN 26.2 million lower. The zero-one variable distinguishing pandemic periods has also been included in the model; however, its impact has not proven to be statistically significant. This model was estimated with the random model method (validity of this choice is confirmed by the results of F-test (p < 0.0001) and Hausman Test (p = 0.1167)).

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Table no. 8. Results of per capita revenues model estimation – model 3: *Revenues_pc = f(Credits_pc)*

	B	*S(B)*	*z*	*p*	
const	57.486	10.719	5.363	<0.0001	***
Credits_pc	-0.059	0.573	-0.103	0.9178	
U01	-26.157	2.331	-11.220	<0.0001	***
LSDV R^2	0.9397				
F-test	F(4; 28) = 50.225; p < 0.0001***				
Joint test on named regressors	F χ^2 (2) = 134.127; p < 0.0001***				
Hausman Test	χ^2 (1) = 2.468; p = 0.1167				

B – regression coefficient, S(B) – standard error, z – z statistics, p – probability in the z test. U01 – binary variable, x = 1 for the 1st half of a year. Estimation method – random model.

The conducted analysis indicates the lack of a visible trend in changing the strategy of banks to support the sustainable development of companies operating in areas shown in Taxonomy. The dynamics of the increase in the value of loans and credits in studied industries is similar to the dynamics noted in the case of companies in total. Furthermore, correlations between the value of credits and loans and the amount of revenues in the group of studied entities have not been confirmed. Admittedly, some previous studies indicate the importance of green innovations and green financing in increasing the profitability of enterprises and decreasing the risk (Lin, Zhu 2019); however, in other studies, it was stated that innovations in the scope of green products do not have a significant impact on the efficiency and results of an organization (Testa, D'Amato 2017; Trumpp and Guenther 2015). The financial market can effectively allocate funds, reduce financing costs and facilitate the acquisition of energy-saving technologies to lower environmental pollution (Tamazian 2009). Development of financial markets taking into consideration assumptions and guidelines in the scope of sustainable development actively promotes the use of environment friendly technologies (Yahya, Rafiq 2019) and an increase in enterprises whose activities meet the requirements presented in Taxonomy (Huchet-Bourdon et al. 2018), however, for the moment, measures undertaken by financial institutions in Poland to the benefit of sustainable development of preferred industries are not reflected in financial results of business entities. Moreover, the COVID-19 pandemic significantly disturbed financial and economic activity since numerous and long-term restrictions had harmed the implementation of ongoing projects and investment in new ones to benefit sustainable development (Anser et al. 2021; Yahya et al. 2021). Concerning the pandemic, ensuring progress in achieving sustainable development objectives slowed down in most countries, mainly due to the lack of additional financial support and the lack of favourable conditions for execution thereof (Barbier, Burgess 2020). Turbulences related to the COVID-19 pandemic changed the business environment of banks and the image of Polish entrepreneurship; therefore, although in the described models, the impact of the COVID-19 pandemic on the relation between credits and results of organizations operating in studied industries proved to be statistically insignificant, the differences and divergences are visible in each of the studied areas.

Conclusions

Taxonomy is a document that creates preferential areas of green financing, as envisaged, that should support sustainable entrepreneurship development. The transitional period between the publication date and the binding date of the document should be used by Polish banks to prepare and implement mechanisms allowing the full implementation of taxonomy assumptions in the processes of financing enterprises. Following the obtained research results, during the phase of implementing taxonomy in Poland, no distinct tendency to redirect the attention of banks and financial institutions to issues related to supporting sustainable development of preferred industries was observed, which indicated the necessity to verify and, ultimately, improve the flow of information in the scope of communicating the aim and assumptions of Taxonomy between financial and non-financial entities operating on the Polish market with the active support of the State's economic policy. Among main research restrictions, in particular, the short period of data subject to the analysis (2018 – June 2020) should be indicated, resulting from the initial phase of introducing Taxonomy in banking. A critical issue impacting the

research results was also the COVID – 19 pandemic, which, due to the introduction of numerous restrictions in conducting business activity in Poland, directed the attention of banks to the introduction of procedures securing the risk of crediting groups of enterprises at risk of insolvency. Due to the lack of obligatoriness and long-term implementation, taxonomy and green finances were postponed. Nevertheless, since January 2022, taxonomy has been a binding provision which should be explicitly reflected in banking strategies and products. The analysis of the level and manner of Taxonomy's implementation in Polish banking will be the subject of research in another study, including the analysis of data for the first year when the document has been binding in Poland.

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