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Differences in End-Customer Power Prices Across the EU – Reasons and Challenges for the Future

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Abstract:
Many years have passed since the first liberalization processes in the electricity sectors the in European Union that were performed in order to establish a single market for electricity. In practice, convergence between neighbouring market areas was established mainly between the Member States in Central-Western Europe, while other countries have allowed for only limited levels of competition. As a consequence, many market areas remain illiquid and consumers pay relatively higher prices for the energy they consume. The final bill is further increased through financing the increasingly ambitious climate agenda, gradually leading to social opposition against ever-growing prices. The aim of this article is to provide examples of differences in market functioning in Member States, leading to discrepancies in average energy costs for end consumers. The consequences of different levels of market concentration, infrastructure investments and renewable generation subsidization are analysed using publicly available statistics. Careful literature review is also performed before the conclusions are presented.
Keywords: Clean Energy Package, RES, energy mix, CRM, subsidies.

1. Introduction

Liberalisation of the electricity sector already has a history in the European Union (EU), although it is not broadly understood and recognized by the society [10]. The term *liberalisation* refers to the splitting of the previously vertically integrated entities that have held a monopoly on the power sector along the entire business chain under one roof and exposing part of the sector to competition. Through such *unbundling*, energy companies have been split into those responsible for production, transmission, distribution, supply and trading. The transmission side was seen as a "natural monopoly" i.e. an area where market-based competition would be counterproductive due to the way through which electricity can be transferred [24] – building parallel, competing transmission or distribution lines would not be possible both due to the associated costs and public resistance. This way, national monopolies in form of Transmission System Operators (TSOs) and Distribution System Operators (DSOs) have been established. The other areas of the business chain were exposed to competition, which was made possible largely thanks to the Third-Party Access (TPA)

principle, ensuring unprejudiced access to transmission and distribution systems at a regulated price to all system users as per art. 20 of Directive 2003/54/EC of the European Parliament and of the Council. It should be noted here that the principles of non-discriminatory access to power transmission and distribution systems was laid down already in articles 7 to 12 of Directive 96/92/EC establishing the first set of common rules for the internal market in electricity.

Implementation speed and scope of the EU rules across the Member State varied significantly and over the years and still varied at the time of preparing this article. As a result, the benefits of market liberalisation also vary, leading to a spectrum of opinions over the success or failure of the market for electricity in Europe. This article provides an overview of the development stage of the power markets in Europe and the consequences this has on the prices and future economic competitiveness of the Member States in general. First, the status-quo of the electricity markets in 2019 is presented. This section is followed by an overview of the electricity prices for non-households customers in chosen Member States and possible explanations for their levels. Finally, the potential future developments of the end customer prices in the EU are outlined in the context of the competitive position of its Member States and conclusions are presented.

2. Electricity Markets Status-Quo in Europe

The so-called Electricity Directive, laying down the common rules for the internal market for electricity inside the EU has seen three recasts already since its original version of 1996 [4;5;7]. Several legislative packages have been brought about along with the recast Electricity Directives:

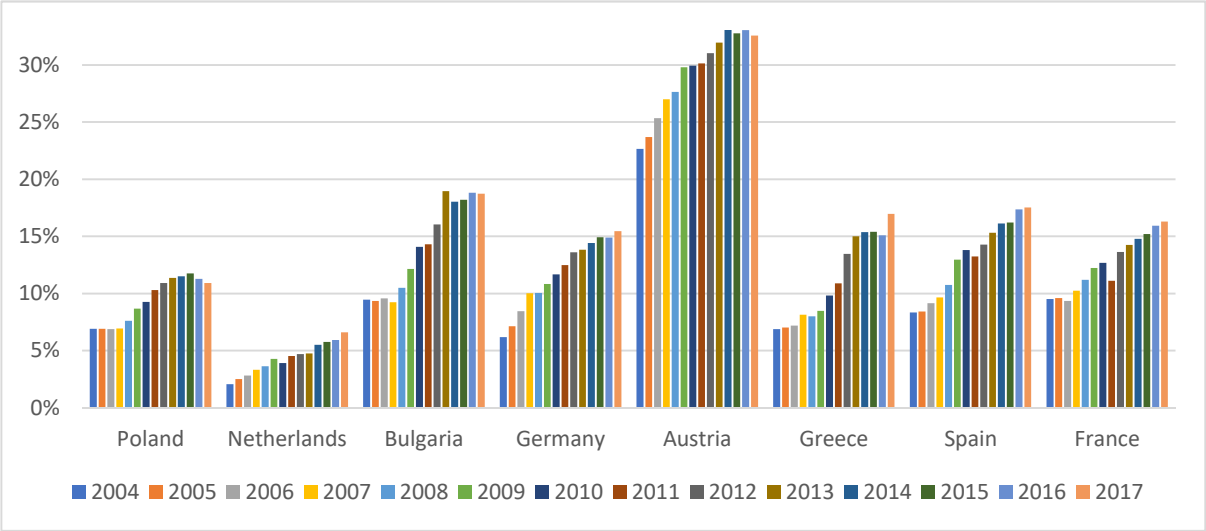
- First Energy Package, 1996 – the first "package" in terms of electricity market was in fact the Electricity Directive in itself, laying down the fundamental market principles. It was referred to as a package together with Directive 98/30/EC that liberalized the natural gas sector as well.
- Second Energy Package 2003 – the second Electricity Directive doubled the size of the agreed provisions, at least in the number of pages. This time it was also supplemented with Regulation 1228/2003 [25] on accessibility of cross border electricity exchanges – this document called for greater cooperation between TSOs and improved commercial access to interconnections (i.e. transmission lines connecting two countries) between Member States.
- Third Energy Package 2009 – third and by far broadest legislative package that has entered into force at time of preparing this article, consisting of two directives (one of which was the Electricity Directive, the other was on natural gas) and three regulations. Previous Regulation on network access to cross-border electricity exchanges was updated through [26; 27], establishing European Network for Transmission System Operators (ENTSO) for power and gas. Second Regulation [26] has established the Agency for the Cooperation of Energy Regulators (ACER). Together, they were to enhance cross-border cooperation and streamline implementation of the Package.
- Clean Energy Package 2019 – the latest set of legislation, consisting of the revised Electricity Directive and three Regulations – one on risk-preparedness of the electricity sector in the EU [28], one on the internal market for electricity [30] and one revising the Regulation establishing ACER [29]. The Clean Energy Package has enforced a set of regulations limiting the subsidisation of fossil-fuel based electricity generation and enforced international coordination of measures ensuring electricity supply adequacy at all times.

The concept of liberalized, interlinked power systems across the European Union had to face tremendous reluctance from the Member States attempting to protect the interests of the former incumbents in their country. This was done in a number of ways, including punitive licensing and reporting obligations for new entrants, requirements to use the national language, taxes on exported electricity etc.

Apart from market liberalisation, another notable change over the past 20 years that shaped the power markets as they are now, was a shift towards production from Renewable Energy Sources (RES). Public pressure from the society has popularized subsidy schemes for the development of energy sources that are considered to be environmentally friendly, particularly wind turbines and solar photovoltaics (PV). Substantial incentives have been offered to investors in this field,

attracting many new entrants to the energy industry and developing substantial share of renewable energy in their energy production (see figure I).

Figure 1. Share of energy from renewable sources in the national energy mix (%).



Source: own elaboration based on [13].

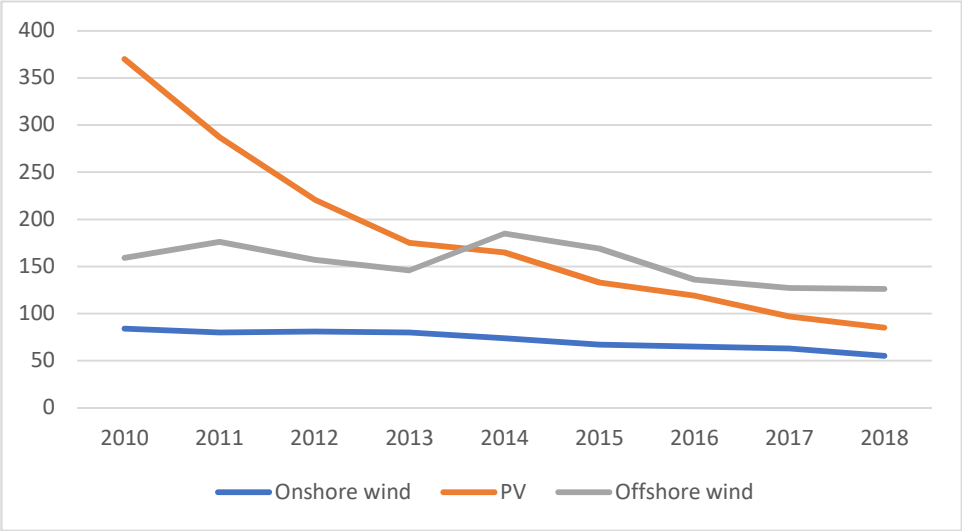
Information on figure 1 indicate that the share of RES has grown notably between 2004 and 2017. Interestingly enough, many Member States are still far away from their ambition laid down in the so-called Renewable Energy Directive to reach a 20% share of renewable energy in their national energy mix until 2020 despite the substantial cost of the incentives that were offered. Development of renewable energy sources, particularly of wind- and solar- based generation, had downsides also from the electricity market perspective. These include:

- **Higher balancing costs –** for most system users i.e. the costs that the TSOs and DSOs bear in order to ensure that supply equals demand at any time, as it is a precondition for the security of supply. These costs are distributed between the system users, yet some support schemes have exempted certain RES from their responsibility to bear their share of the costs to make the investment more attractive.
- **High intermittency –** an increasing share of renewable generation in an electricity system is at the same time the main reason of growing system balancing costs. The output from most RES that are weather based is highly intermittent and results in significant amounts of energy appearing and disappearing from the system as the weather conditions change. This forces the system operators to ensure sufficient backup at times of unfavourable weather conditions.
- **Non-market prices –** some support schemes offered the investors to offtake their production at any time at a price fixed upfront (so-called feed-in tariffs). This has made the investor's risk fairly small and at the same time it has detached his generator from the market reality, where he had no incentive to increase or reduce his output for any reason, potentially moving away the system further from balance.

A combination of support scheme costs and higher system balancing costs, has led to a situation, where power prices for end customers have not decreased despite the fact that both wind turbine and PV have negligible operating costs and their total cost is in decrease for years.

Figure 2 represents the weighted average levelized cost of energy (LCOE) of wind turbines and solar photovoltaic, which represents the total lifecycle costs of installing and operating a generator divided by its total electricity output. The total cost of these technologies has dropped particularly for PV. The author believes that the changing investment cost in renewable energy sources is yet another argument why subsidy schemes detached from the changing market conditions, such as feed-in tariffs, have proved to be very costly and unreasonable.

Figure 2. Wind and power generators levelized cost of energy (USD/MWh).



Source: own elaboration based on [14].

Altogether, renewable generation incentives and deviations from full implementation of the EU acquis for the electricity market, have led to a situation where household prices still need to be regulated and the industry often has to face increasing electricity costs. This situation could suggest that the energy system transition towards market-based competition was a mistake as can be observed in certain reports [2] and publications [22].

In the following section the subject of energy costs to end-customers will be discussed in the broader context to identify the drivers of their evolution over time. Relevant Eurostat statistics shall be analysed for eight EU countries representing a different stage of development in order to discuss different reasons for consumer price evolution scenarios. A relatively small-sized, non-household consumer group (consumption up to 70 000 MWh/year) has been chosen for the analysis, as this is the group that typically does not benefit from any form of price regulation or subsidies to their consumption and therefore represents the average energy costs quite well. Explanations for the respective price curve shapes are then sought in literature and official documentation of the relevant authorities, particularly the system operators and energy regulatory offices. Eurostat database has also been used to extract the share of taxes and levies the examined consumers pay in their electricity bills in order to identify to what extent the final price is a result of supply and demand equilibrium on the market.

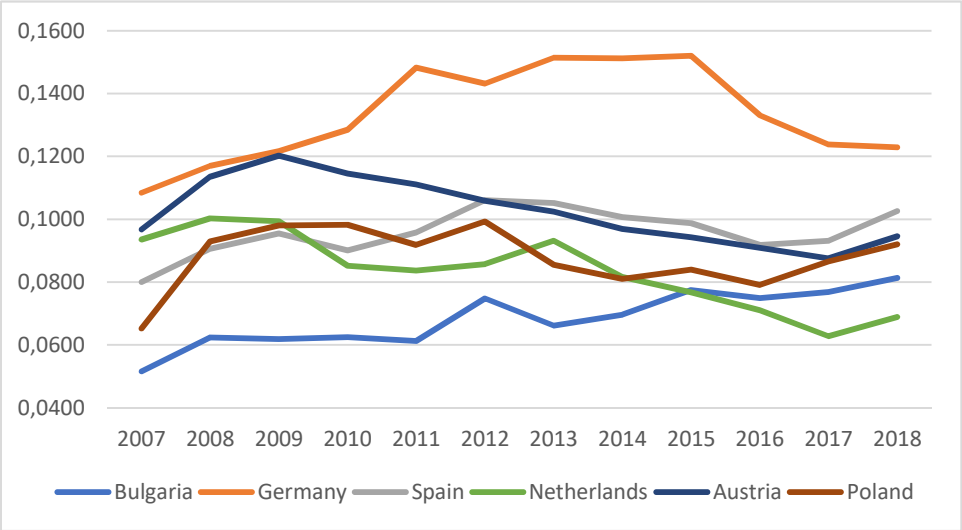
3. Electricity Prices in Different Member States

Different market development stages can be observed across Europe. While North-West Europe (NWE) region has developed substantially and their markets are increasingly integrated especially in terms of short-term power prices, countries in Central and South-Eastern Europe (CSEE) are still monopolized to a large extent and are isolated from their neighbours, effectively still not in line with the spirit of the Third Energy Package of 2009. It should also be noted that while NWE countries have largely liberalized the prices for all end customers, many other countries still administer the prices that can be offered to households. Therefore, for the purpose of this article, only non-household consumer prices are analysed in order to reflect the impact of the national policies.

In this section, eight national markets from both regions are analysed in order to evaluate the potential consequence of such different market development stages to the competitiveness of the economy: Bulgaria, Germany, Spain, Netherlands, Austria and Poland. The choice of specific Member States from these regions for the analysis was largely dictated by the author's knowledge of the way the electricity sector has developed in these countries over the past years. The timeframe was limited by the availability of the relevant statistics to years 2007 to 2018. It should be noted

that the electricity market in each Member State has its own characteristics that affects the resultant electricity costs and the analysis presented below highlights only the features of these markets that can be affected by the decisions taken by the national authorities.

Figure 3. Average electricity costs for non-household consumers consuming up to 70 000 MWh/year (in EUR/kWh).



Source: own elaboration based on Eurostat [13].

Figure 3 provides an outline of the average electricity costs borne by a relatively large non-household consumer in six selected countries. This price includes all the taxes and levies associated with the electricity bill received by the consumer in these countries. In 2018 Bulgaria and the Netherlands have recorded an average price of no greater than 0,08 EUR/kWh. The highest electricity price has been recorded for Germany even though it has decreased substantially since 2015. The results can be surprising particularly when taking account of the fact that Germany is considered to have the most developed wholesale electricity market in Europe. At the same time the Bulgarian electricity market remains largely monopolized and difficult to access, whereas the prices are among the lowest in Europe.

Bulgaria's electricity market remains to be one of the least developed markets in all of the European Union. The list of market entry barriers is very long, while the scope of interference with the business activities there tended to be substantial over the past years. These include cumbersome trading license acquisition procedure followed by a long list of reporting obligations that generates substantial costs to the system users, discouraging new entrants. License holders are also obliged to pay fees that are calculated against their turnover from trading activities, automatically discouraging engaging into frequent transactions at a wholesale level. More spectacular example of market interference in the case of Bulgaria was the introduction of fees on cross-border transactions back in 2012, ultimately constituting a fee on exports and imports of electricity on the internal market of the European Union. This approach was changed only recently with the amendments to the Energy Law from July 2019. The observed electricity price actually stems from the national energy mix that is based on legacy investments in conventional power plants and nuclear power, that are fully amortised, and their costs are relatively low [18].

The case of the Netherlands is far from the Bulgarian case – the country has pursued the liberalisation of the power market quite well and remained open to cooperation with its neighbours. At the same time, it should be noted that some non-household consumers (such as the ones analysed in this articles) can benefit from substantial tax discounts on the electricity they use in their production processes [3].

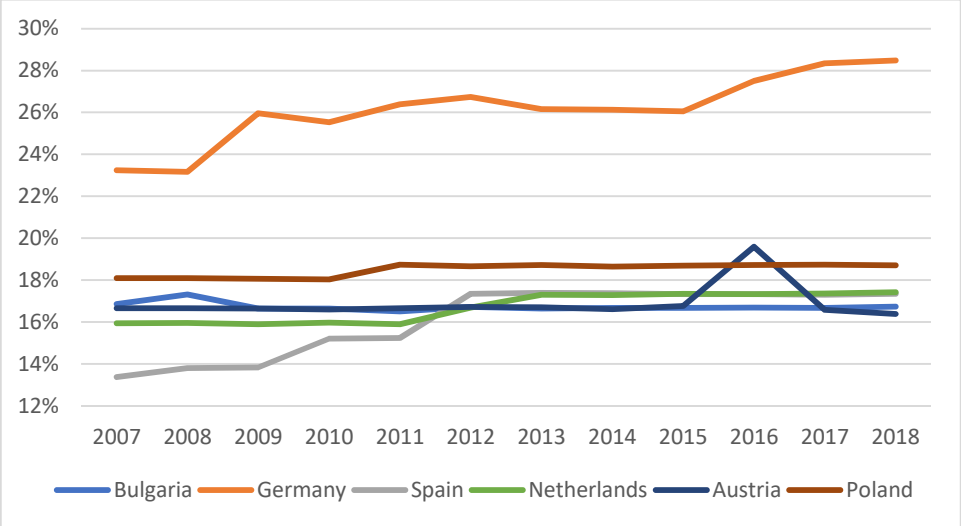
The Spanish power market is an example of relatively well-developed market, where substantial funds have been invested in renewable generation, partly under the feed-in tariff regime

[31]. At the same time, substantial investments in highly flexible, controllable natural gas-fired generators had to be taken, leading to a situation where the latter electricity source began to set the marginal price for the market [14].

The Austrian market should formally be classified to the CSEE region, yet the aspirations of the national authorities and the long-established cooperation with the German market would rather position Austria among the developed markets of NWE, especially since the country was operating in a common wholesale price zone with Germany between 2002 and 2018 [12]. The decision to split both markets was dictated by the physical constraints existing between the transmission systems of both countries – at times of high electricity production from wind in the north of Germany, the national grids was not able to accommodate all the commercial imports into Austria and the surplus energy unexpectedly started flowing through the Polish and Czech transmission systems (so- called "loop flows") leading to security of supply issues due to the overload of the transmission lines [23]. The split has affected the electricity prices in Austria and remains a very contentious subject between the Member States affected by the "loop flows".

Poland has started the liberalisation process relatively well from a wholesale power market perspective after taking a decision to split the former incumbent into four competing companies. The development of market liquidity that followed, was however undermined by a number of impediments ranging from entry barriers (in particular the license acquisition procedure and the obligation to pass a trader's exam in Polish in terms) to compliance risks in commercial operation due to general lack of transparency from the authorities and multiple, often overlapping reporting obligations. Nonetheless, Polish electricity market was progressing despite relatively high market concentration and the prices were relatively low due to ample generation capacity. More recently, through decision to suspend the power market and administer the electricity prices for some end consumers for 2019 [32] much of the progress made was foregone, as companies became discouraged or unable to continue business activities in Poland.

Figure 4. Share of non-refundable taxes and levies in the total electricity costs for non-household consumers consuming up to 70 000 MWh/year (in %).



Source: own elaboration based on [13].

The case of Germany's electricity market was intentionally left to be analysed last, due to the dissonance between the liquidity and maturity of the market at the wholesale level and the prices offered to end customers. German market is functioning well, offering fast and easy access to wholesale trading without a multitude of overlapping reporting obligations or measures constraining competition, which has resulted in a traded volume level much larger than the rest of the EU wholesale markets combined. In order to explain the phenomenon of the tremendous gap between wholesale prices and end-customer bills the level of taxes and levies imposed on end customers should be quoted (see figure 4).

Over the past twelve years, the share of non-refundable taxes and levies in the total electricity costs for non-household consumers in Germany has exceeded 25% and is coming close to 30% in 2018. This trend is a consequence of different policies ranging from coal- and nuclear-based generation phase-out [17] to measures supporting development of RES and biogas, including generous feed-in tariffs [19]. Information on figure 4 also indicate remarkable stability of the share of the aforementioned taxes and levies over the past five years in other countries. Nonetheless, it is important to underline that the share of non-market related costs in the end-customer electricity bill is typically around 17%. The example of Spain in this context can be particularly interesting – the end of the ramp-up of taxes and levies share in non-household prices coincides with the decision to phase-out feed in tariffs for new RES and retroactively limiting the subsidy scope that was already granted [21].

4. Electricity Prices in the EU Going Forward

Development of liquidity on a market in different timeframes is a process that takes time and its success is highly reliant on the trust that users along the value chain build in the market [12]. Changing regulatory environment can only harm that trust. The scale of interference with the power market over the past years have resulted in substantial financial losses for companies that have tried to compete and invest in countries like Poland or Bulgaria. The importance of having a liquid and competitive electricity market can be observed on the example of Germany – if it wasn't for the remarkable competition level and the associated liquidity of this market that allowed low price at a wholesale level, the burden of taxes and levies would be hard to bear by the industry. This conclusion only underlines the need for the CSEE-region Member States to ensure full compliance with the EU acquis, not only in legal terms but also in practice, so that they can benefit from an interconnected, liquid internal market for electricity.

Another aspect of interference with the market is the fact that, as a result, the market is not capable of forming the right price signals to encourage new investments. The specificity of the electricity sector is particularly vulnerable in this aspect, as most industrial-size investments are both highly capital-intensive and take a lot of time to develop. Unfortunately, the proposed measure to solve this problem, instead of improving the general market environment, has taken the form of a so-called "capacity remuneration mechanism" (CRM) under which power generators are paid for becoming/remaining available to meet the demand at all times. This type of subsidies can be either price- or volume-based [1], but in both cases, they offer additional remuneration to producers, affecting the price formation on the market and adding directly to end-consumer bills once again. The author also believes that very often the design of CRMs considers the electricity supply adequacy of a Member State in isolation from its neighbours, leading to different level of subsidization and affecting the competitive position of producers on the EU internal market.

Finally, although as highlighted before, substantial investments have been made in developing new renewable energy sources, most Member States will probably fail to meet their 20% RES share in gross energy consumption target by 2020. It is therefore worth to analyse what impact will the increased targets until 2030 and beyond will have on the future electricity prices in Europe. The author believes that a simple extrapolation of the historical costs of developing renewable energy into the future would be incorrect, both because of the observed reduction in the investment costs (see Figure 2) and because Member States have realized that subsidy schemes detached from market reality are not fit for purpose. Nonetheless, especially when considering the most recent ambition under the Clean Energy Package of reaching 32% of RES in the consumed energy mix by 2030, the costs of the desired transition will be remarkably high, especially since such a high share of intermittent generation will still require maintaining substantial controllable generation capacity as backup.

5. Conclusions

European Union's ambitious climate policies affect the end-customer electricity bills in a number of ways, ranging from direct taxes related to financing the RES subsidies to additional measures taken to ensure sufficient reserve capacity to meet the peak demand at all times. Even if less market-intrusive ways of promoting renewable energy are implemented in the future, they are bound to contribute to further inflation of the electricity prices, especially if the targets for the share of non-fossil-based energy consumption are increased further.

The problem of policy-related costs of electricity paid by the consumers was analysed in the context of the market development stage. This was to prove that through competition and increased efficiency, electricity markets have the potential to reduce the wholesale power prices substantially, helping the end-customers to bear the costs of the increasing taxes and levies. The author believes that an integrated, liquid EU electricity market can enshrine the competitive position of the Member States in terms of the costs of the energy consumption. Allowing greater competition through eliminating regulatory barriers to conduct business activities on all electricity sectors in the EU could ensure both the necessary investment signals to ensure generation capacity adequacy and promote the development of RES without excess subsidization.

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Public Debt Management and The Country's Financial Stability

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Abstract:
The government debt portfolio is usually the largest financial portfolio in the country. It often contains complex and risky financial structures and can generate significant risk to the state budget and the country's financial stability. Therefore, governments are required to have sound risk management and sound public debt structures to limit exposure to market risk, debt financing or rolling risk, liquidity risk, credit, settlement and operational risk. In recent years, the debt market crises have highlighted the importance of sound public debt management practices and related risks, and the need for an effective and well-developed domestic capital market. This may reduce the vulnerability of the economy to adverse economic and financial shocks. However, it is also important for the government to maintain a macroeconomic policy that ensures sound fiscal and monetary management. The aim of the research is to present the theoretical and practical aspects of extremely important issues such as public debt management and to indicate the most important implications for the financial stability of the country on the example of the Polish economy. The study uses a research method based on literature studies in the field of macroeconomics, economic policy and finance, as well as statistical analysis of the studied phenomenon. Results of research indicate that effective public debt management can reduce the economy's vulnerability to financial threats, contribute to the financial stability of the country, maintain debt stability and protect the government's reputation among investors.
Keywords: public debt, sovereign debt management, budget deficit.

1. Introduction

The occurrence of public debt means that the ability to effectively manage this debt is becoming increasingly important. The process of public debt management is increasingly indicated as an essential element of national fiscal policy [7].

Theories on optimal public debt management have set different goals for public debt management. They concern macroeconomic stabilization, development of national financial markets, support for monetary policy and minimization of debt servicing costs and public debt risk. The macroeconomic objectives for public debt management clearly distinguish them from debt management in the private sector, where cost considerations prevail. In addition, assets and

liabilities in private enterprises are usually directly related (e.g. issue of bonds or equity to finance expansion or acquisition of an enterprise), while in the public sector such direct connections are usually absent. The starting point for any discussion on the objectives of public debt management are the considerations of J. Tobin, who treated public debt management primarily as a tool for macroeconomic stabilization. He argued that minimizing interest costs is of secondary importance and that risk minimization does not play any role. In the context of the economic recovery, new debt issuance should focus on long maturities, raising long-term interest rates, thus helping to cool the economy [13].

In turn, Alessandro Missale indicates stabilization of the budget deficit as the main goal of sovereign debt management. He argues that fluctuations in the budget deficit to GDP ratio can be minimized by choosing the right debt instruments. The optimal debt structure depends on the direction and strength of the correlation between inflation, real GDP growth and interest rates. Assuming that the central bank attaches great importance to price stability, its model shows that a combination of long-term conventional debt and inflation-indexed debt would be optimal for stabilizing the budget deficit. The cost of using debt instruments to reduce the likelihood of the budget balance exceeding the budget deficit limit in relation to GDP should be compared with the cost of the deficit exceeding this limit [8].

2. The Essence and Goals of Public Debt Management

In the opinion of the World Bank and the International Monetary Fund, the public debt management process should include issues of obtaining the required amount of funds, achieving the assumed risk and cost of incurring debt, and achieving other objectives, which include the development of the securities market. The main goal of public debt management is to meet the state’s borrowing needs in the long run at the lowest possible cost and at the assumed risk level.

Public debt management is a complex process, which results from the interdependence between public debt and other macroeconomic indicators. The long maturity of many debt instruments and the long-term nature of debt mean that public debt is also a long-term category.

The public debt management process can be defined as open market operations carried out by the government to change the structure and share of government debt instruments. Public debt management focuses only on changes in the structure of unpaid public debt. Public debt management mainly concerns changes in the structure of its maturity.

Public debt management can be defined in a broader sense and narrower sense. In a broader sense, public debt management is one of the elements of the fiscal policy pursued by the government. In this perspective, this process determines how much government expenditure is financed by incurring debt. In turn, in a narrower sense, public debt management is a process that determines the method of financing the state's borrowing needs (choice of markets, financial instruments and dates of their issue) and the process of appropriate shaping the structure of public debt (short-term, long-term debt).

The main goal of public debt management is to minimize debt servicing costs in the long-term horizon, with an acceptable risk level for the financial instruments used [15]. These are risks such as refinancing risk, exchange rate risk, interest rate risk, liquidity risk, credit risk, operational risk and the risk of distribution of debt servicing costs over time [1].

Debt refinancing risk relates to the ability to redeem maturing debt and the conditions under which it is refinanced (including in particular the servicing costs generated by the newly issued debt). The higher the maturity payments and the closer the debt maturity, the greater the refinancing risk. The amount of refinancing risk depends on the level of public debt and its maturity structure. In order to reduce the refinancing risk, it is strived to extend the debt maturity period and to evenly distribute the issued treasury financial instruments over time [9].

On the other hand, exchange rate risk is related to the currency structure of public debt. The greater the share of debt in foreign currency, the greater the exchange rate risk. In order to limit the

exchange rate risk, it is aimed to reduce the share of debt denominated in foreign currencies and to shape the desired currency structure of debt by using derivatives.

Interest rate risk is defined as the risk of a negative impact of market interest rates on the current and future value of public debt and its servicing costs. The larger the share of debt with a fixed interest rate, the greater the interest rate risk. Therefore, in order to limit the interest rate risk, variable rate and inflationary (indexed) bonds and interest rate derivatives are used.

The risk of the state budget liquidity concerns the possibility for the state to regulate current liabilities for the purchase of public debt and its timely service. In this situation, the state strives to maintain a safe level of liquidity of the state budget with effective management of liquid assets. In order to limit the liquidity risk, free funds in the national currency and in foreign currencies at the disposal of public finance sector units and derivative transactions are used to shape the appropriate structure of liquid assets.

Credit risk relates to a situation in which a party to a transaction fails to fulfill its obligation, in whole or in part. In order to limit credit risk, appropriate transaction partners are selected, characterized by high creditworthiness (rating), and maximum market exposure limits are set depending on the partner's creditworthiness and the type of transaction being carried out.

Operational risk is associated with a situation in which costs related to debt management or the level of other types of risk will increase as a result of infrastructure inadequate to the scope of tasks as well as organization and control of debt management. In order to limit operational risk, integrated public debt management is introduced in one organizational unit, whose structure, infrastructure and procedures are adapted to efficient operation in both state administration and the financial market.

Finally, the risk of the distribution of debt servicing costs over time relates to a situation in which, for various reasons, there is an uneven distribution of public debt servicing costs over individual years. In order to evenly distribute debt servicing costs in individual years, derivatives are used and bond coupons are set at a level slightly below their forecasted profitability in the sales period.

In recent years, International Monetary Fund and World Bank guidelines on public debt management have been developed to help policy makers consider reforms to improve the quality of public debt management and reduce their country's vulnerability to international financial shocks. The guidelines apply to both national public and external debt and cover a wide range of financial claims against the government. The guidelines identify areas of increasing convergence in prudent public debt management practices. Belong to them:

a) recognition of the benefits of the clear objectives of debt management;
b) risk-weighting of costs;
c) separation and coordination of goals and obligations in the field of public debt and monetary policy management;
d) determining the debt expansion limit;
e) the need for careful management of refinancing and market risk as well as interest costs related to debt;
f) the need to develop a solid institutional structure and operational risk mitigation rules, including a clear delegation of responsibilities and associated responsibilities between government institutions involved in the sovereign debt management process.

3. Public Debt and the Macroeconomic Situation of the Country

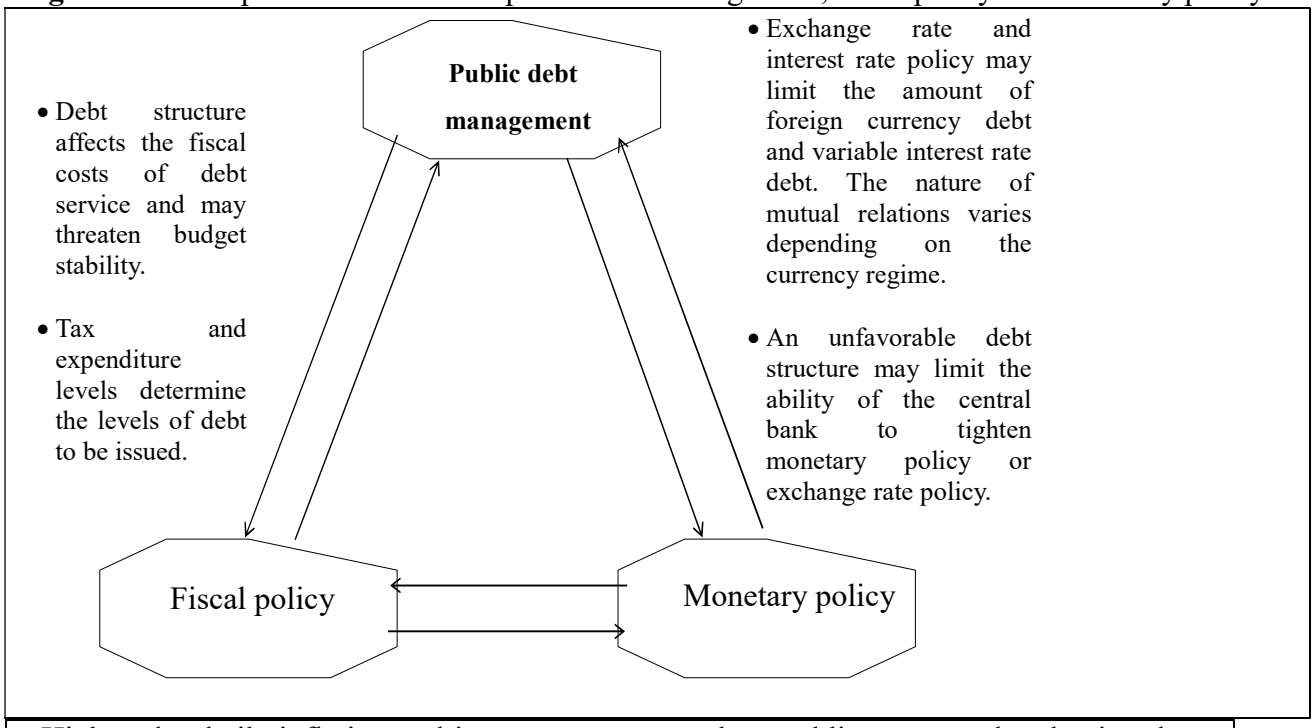
Inappropriate public debt management can force the fiscal authority to change the current policy direction, because an unfavorable debt structure can suddenly increase debt servicing costs and force the government to cut planned expenditure to meet its obligations. On the other hand, improperly conducted fiscal policy can affect the efficiency of debt management, because tax policy and spending policy determine the levels of primary surplus/deficit and the amount of debt to be issued. When this level is excessive, investors will demand a higher risk premium and may prevent

debt managers from issuing a given debt instrument at a reasonable cost and achieving the target debt structure.

Monetary policy can also limit the actions of public debt managers, since exchange rate policy and interest rate policy can limit the value of foreign currency debt and variable interest rate debt. For example, debt managers may be forced to limit the share of long-term debt with a fixed interest rate in the national currency or they may be forced to incur debt at very high costs, as investors may expect higher inflation or devaluation of the national currency in the future due to loose monetary policy. In such circumstances, investors may prefer debt indexed to inflation rates or short-term interest rates, debt with short maturity or debt denominated in foreign currencies. In turn, domestic debt with a large share of short-term debt, variable-rate debt or foreign currency debt may limit the central bank's willingness to raise interest rates or the depreciation/devaluation of the national currency, as this may lead to a debt crisis.

Finally, monetary policy and fiscal policy are interdependent, as high and volatile inflation and thus real interest rates can reduce public revenues by slowing down private sector economic activity, and sterilization by the central bank and quasi-fiscal deficits can directly increase debt levels. Inappropriate budgetary management and high levels of debt can put monetary policy goals at risk, as they can increase inflation and inflation expectations, and can increase real interest rates and / or depreciate the currency, leading to reduced financial stability [14].

Figure 1. Interdependencies between public debt management, fiscal policy and monetary policy.



• High and volatile inflation and interest rates can reduce public revenues by slowing down private sector economic activity. Sterilization and a quasi-fiscal deficit can directly increase the level of debt.
• Inadequate budget management and high levels of debt can increase inflation expectations and cause interest rate increases and / or currency depreciation.

Source: [14].

The country's financial stability can be broadly understood as the stability of financial markets, reflected in the low level of volatility of a number of economic and financial indicators, including prices, money supply, credit for the private sector, exchange rate, share prices, bond spreads, interest rates and currency swaps. However, the traditional concept of financial stability focuses on one dimension or price and one characteristic, i.e. low volatility [11].

Aerdt Houben, Jan Kakes and Garry J. Schinasi point to three major functions of finance in the modern economy that could help develop a broader definition of financial stability. These include promoting effective allocation of real economic resources, facilitating the transformation of maturities to meet the needs of lenders and borrowers, and appropriate pricing and financial risk management [4].

Garry J. Schinasi made three observations that can be used to determine financial stability. First, financial stability is a broad concept covering various aspects of financing (infrastructure, institutions and markets). Secondly. financial stability means that resources and risk are effectively allocated and valued and the payment system works efficiently. Thirdly, financial stability concerns not only the absence of financial crises, but also the inherent ability of the financial system to avoid, reduce and cope with imbalances that could threaten economic systems or processes [10].

In general, the presence of a well-functioning public debt market helps to build and develop efficient financial markets. The development of the financial market is an essential element to ensure stable economic growth. A healthy financial market allows for more effective orientation of the country's savings on investments. More efficient financial markets also allow long-term loans to individuals and businesses. Such loans help increase investment in a more stable way, enabling the financial system to promote efficient capital allocation and transformation of maturities. Given their size and lower risk compared to other domestic issuers, public debt issues are an appropriate instrument to facilitate this process. Instruments should be designed to contribute to the development of efficient and liquid financial markets that facilitate financing the development of enterprises in a given economy [2].

Actions taken and policies implemented by sovereign debt managers can promote financial market development and financial stability. Their role has gained a high position in the context of managing the effects of the recent crisis, during which the level of debt in many countries increased significantly in a relatively short time. The increase in the level of debt has increased pressure on financial markets to meet the higher financing needs of governments, which could threaten an increase in the profitability of debt instruments and the generation of sub-optimal debt structure. The public debt management strategy is therefore a necessary complement to properly run macroeconomic policy, an appropriate political environment and a sensible choice of political regime to achieve financial stability [16].

4. Global Practices in Public Debt Management

When analyzing the changes in global public debt in the years 1980–2018, it should be stated that the average level of public debt in the analyzed period increased from 40% of GDP in 1980 to over 80% of GDP in 2018 with a clear tendency for further growth. In most of the years surveyed, the average share of public debt in relation to GDP in the group of high-income countries was much higher than in the countries with medium and low income.

Table 1. Public debt in relation to GDP in selected countries of the world (in%) (from the highest to the lowest).

Japan	234.18%
Greece	181.78%
Sudan	176.02%
Venezuela	172.08%
Lebanon	160.57%
Italy	127.51%
Eritrea	127.34%

Barbados	127.31%
Cape Verde	126.66%
Portugal	117.54%
Mozambique	116.60%
USA	109.45%
Singapore	108.79%
Gambia	105.17%
Republic of Congo	105.01%
Bahrain	102.01%
Belgium	99.08%
....	
Poland	49.80%
... ..	
Brunei	2.46%

Source: [5].

The global financial crisis of 2007-2009 meant a further deterioration of the fiscal situation in many countries of the world as well as deepening budget deficits and an increase in public debt in these economies. Compared to the 1980s and 1990s, the budgetary position has generally improved only in low-income countries. The shorter the debt maturity, the higher the amount of debt to be refinanced in a given period and the higher the risk of refinancing the debt. The average share of short-term debt in total public debt globally dropped from 24% in 1995 to around 11% in 2018. Private creditors granting loans to the state did so over the period considered for an average period of close to five years, while official creditors signed loan agreements for the State with maturities exceeding 20 years on average.

As it is known, the debt expressed in a foreign currency is additionally exposed to the risk of exchange rate changes, which means that the depreciation/devaluation of the national currency increases the value of debt denominated in foreign currency expressed in the national currency. Public debt expressed in foreign currencies has slightly increased in the last 20 years. It currently accounts for around 36% of the total global public debt. At the same time, it should be noted that the percentage of debt denominated in foreign currency was the highest in low-income countries and the lowest in high-income countries. Public debt denominated in foreign currencies was incurred mainly in US dollars, the share of which increased during the period considered and amounted to about 60% in 2018. In second place in terms of share was the debt in the euro (13%), and third in the Special Drawing Rights (SDR) issued by the International Monetary Fund (6%). High-income countries have mainly borrowed from domestic creditors. Their share in total public debt was about 75% in 2019. In turn, middle-income countries divided their financial needs almost equally between domestic and foreign investors, while the debt of low-income countries was mostly financed by foreign creditors.

5. Public Debt Management in Poland

Analyzing the changes in the volume and structure of public debt in Poland in the period 2008-2018, one can notice a systematic decline in the share of public debt in GDP from nearly 52% in 2010 to just over 46% in 2018. The largest share in the total state debt was domestic debt, the share

of which oscillated around 70% in the entire analyzed period, and the average maturity of public debt in 2008-2018 was close to 5 years.

Table 2. National public debt in Poland in 2008-2018.

Specification	2008	2010	2012	2014	2016	2018
Public debt in relation to GDP in%	46,5	51,7	51,6	48,1	51,9	46,5
Share of domestic debt in%	73,7	72,2	68,4	64,5	65,6	70,7
Share of foreign debt in%	26,3	27,8	31,6	35,5	34,4	29,3
Average debt maturity in years	5,3	5,4	5,5	5,2	5,3	5,0
Share of debt with a fixed interest rate in%	95	89	88	81	82	85
Share of debt with a floating interest rate in%	5	11	12	19	18	15

Source: [3].

The largest share in the public debt in the period 2008-2018 had debt denominated in the national currency, which in the entire analyzed period was close to 70%. In turn, the debt denominated in the euro currency accounted for about ¼ of the total public debt, while the debt denominated in USD had a share close to 5%.

Table 3. Currency structure of the public debt in 2008-2018 (in%).

Specification	2008	2010	2012	2014	2016	2018
PLN	74	72	68	64	65	71
EUR	19	20	22	25	25	22
USD	2	4	5	7	6	5
Rest currencies	5	4	5	4	4	2

Source: [3].

The essence and objectives of public debt management in Poland have been specified in the Public Finance Act in relation to tasks carried out by the Minister of Finance, which include:

a) activities related to obtaining repayable funds financing the borrowing needs of the state budget,
b) servicing state liabilities under issued financial instruments and loans and borrowings raised;
c) management of free financial resources of the Treasury, management of financial liabilities and public financial assets.

At the same time, the management of available funds includes operations on financial markets that change the structure of public debt. These transactions are carried out in order to increase the financial security of the state's borrowing needs, reduce the risk or costs of servicing sovereign debt and to perform other tasks related to sovereign debt management.

The Minister of Finance prepares a four-year strategy for public debt management and impact on public debt. The sovereign debt management strategy for the period 2019-2022 adopts a flexible approach to shaping the financing structure in terms of market selection, currency and financial instruments to minimize costs and avoid monetary policy distortions. In addition, it is assumed that the domestic market will still be the main source of raising funds by the state, and the share of debt denominated in foreign currencies will drop below 30%. In addition, the government's priority will be the implementation of large and liquid issues of financial instruments with a fixed interest rate, the average maturity of public debt will be about 4.5 years.

According to the public debt management strategy in Poland in the period 2019-2022, the national debt to GDP ratio will fall to 46.6% of GDP in 2019, and then to 40.7% in 2022. Expenses for servicing the public debt will slightly decrease from around 1.31% of GDP in 2019 to a level

around 1.3% of GDP in 2022. According to forecasts, the share of debt denominated in foreign currency will fall from 26.8% in 2019 to 23.7% in 2022.

Table 4. Forecast of public debt in Poland in 2009-2022.

Specification	2019	2020	2021	2022
Public debt in relation to GDP in%	46,6	45,2	42,9	40,7
Share of domestic debt in%	73,2	74,7	75,7	76,3
Share of foreign debt in%	26,8	25,3	24,3	23,7
Treasury debt servicing in relation to GDP in%	1,31	1,28-1,32	1,27-1,30	1,27-1,30

Source: [12].

It is possible to indicate specific threats to the implementation of the public debt management strategy in Poland in the period 2019-2022. The most important threats include unfavorable changes in the macroeconomic situation in Poland in connection with lower GDP growth dynamics, rising inflation and, consequently, higher interest rates and growing exchange rate volatility. Also threats to the implementation of the above strategy may result from external factors associated with adverse changes in the global macroeconomic situation. This is in particular the forecasted economic slowdown in the world, the protection trade policy of the United States and China, changes in the nature of the monetary policy of the European Central Bank and the Federal Reserve System, as well as threats related to the current geopolitical situation in the world.

6. Conclusion

Inadequate debt structure and inadequate debt management can significantly inhibit the state's ability to ensure financial stability, negatively affecting investors' perception of country risk. The links between financial stability and risk may be feedback. Namely, poor debt management can worsen financial stability, which in turn can increase the risk of the edge, while on the other hand, increased country risk can further reduce the state's ability to maintain the country's financial stability. Some of these effects have become apparent during the recent global financial crisis. At that time, relatively weak positions in the public debt portfolio in some countries negatively affected both economic performance and financial stability of the countries [6].

A proper debt management strategy can play a crucial role in ensuring the country's financial stability by creating an appropriate structure of public debt commitments that maintains a low level of refinancing risk throughout the entire business cycle, ensuring the state's ability to issue the necessary amount of debt at an acceptable cost. Debt managers have a wide range of responsibilities, including the development and implementation of strategies defining in particular the loan instruments that will be offered on the financial market and their maturities. Effective public debt management can reduce the vulnerability to financial threats, contribute to the macroeconomic stability of the country, maintain debt stability and protect the government's reputation among investors. Public debt managers around the world need to strike a balance between borrowing to finance government needs while keeping costs and risks low.

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Assessment of the Financial Condition of Knowledge Based Economy Entities – an Example of Polish Video Game Sector

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Abstract:
The video game producers are currently in spotlight of market information services. Successes and huge budgets of such companies attract many readers. However, scientific studies related to this sector do not share the same popularity. A reflection on the source of value in this sector shows that what generates revenues is not disclosed in the report. Great examples are customers' relationships or the value of employees creating the game code and story of the game. Video games producers sector presents a good combination of business and culture that allows reflection on financial characteristics of knowledge based companies. Prior studies show that market's valuation takes into account unrecognised assets but capital-intensive character of a production and intangibility of a product and its assets causes problems with exact valuation. In this paper the author asks about the impact of the characteristics on the assessment of a financial condition. The research question in this paper is whether it is possible to use and interpret correctly popular discriminant analysis model for knowledge based entities on the example of video game companies. Results are applicable by analysts and managers of this sector and help to determine the usefulness of this method, but it still depends on assumptions and accounting policies. The reflection presented also broadens the discussion on financialisation because analysed companies can oppose this trend in a specific way.
Keywords: financial condition, financial stability, MDA, discriminant analysis.

1. Introduction

Day to day activities of managers of companies are to support the financial condition of controlled entity by operational decisions. Most of the activities are reflected by the data presented in financial reports. The data works as a basis for financial analysis done by all stakeholders who want to assess whether the overall situation of a company is good or bad. To meet this quest, various tools are commonly used, among which the financial ratios play a significant role. Financial condition refers to main characteristics of a company such as profitability, liquidity, efficiency, debt levels or risk level. It is related also to a competitive position or creditworthiness of the company which should

be taken for granted because these main characteristic directly influence the company's position in these areas. All characteristics of the company's situation are always a result of past activities of the company [17]. Despite the numbers of tools used to describe the enterprises "financial condition is a complex phenomenon which means that it is difficult to measure or assess on the basis of one measurable feature" [7, p. 80]. In a large number of possibilities and combinations of different levels of ratios and measures there is a need to clearly define the situation. This need is shed by, for example, discriminatory models where Edward I. Altman is a forerunner with his Z-score model. It is simply a sum of indicator values in appropriate proportions which is understandable for analysts to predict distress of the company. His model has become a standard approach and is widely used by lenders, investors, auditors, bankruptcy lawyers and restructuring advisers. It also shows a way to estimation of other models for company financial condition measurement [1, p. 70]. Still it is based on a result of accounting principles and financial data which, in most cases, does not properly describe the situation of knowledge based entities.

In the author's opinion, among all knowledge based sectors a researcher's attention is mostly attracted by phenomenon of creative industry, which through its diversity and uniqueness shows what was once impossible – it combines different worlds of business and art. One of a greater examples of this misalliance is a video games sector which currently is in spotlight of market information services. Successes, huge production and marketing budgets attract many readers. However, scientific research related to this sector does not share the same popularity. Of course, the sector and every business can be only a setting for analysed problem in the scientific study, however, the features of it serve a multitude of references to current topics. Most of them are a result of intangible character of its value sources which has no full refection in the financial report. Good examples are customer relationships or the value of employees creating the game code and story of the game. These all are a part of intellectual capital (IC) which gives the companies competitive advantage [5]. Despite trends to include more data about IC there is no consensus on the methods [15]. As a financial statement does not include all assets, true view on the profitability is impossible and can reach abnormal levels. Because accounting problems with activating the production costs on the liquidity of the companies of video games sector becomes incomparable [19]. Prior author's studies show also that the video games sector represents higher level of price to book ratio. This proves that these unrecognised assets are taken into account in valuation by stock market investors [20]. This situation leads to a reflection on the methods of assessing the financial situation of the company.

The research question in this paper is whether it is possible to use and interpret correctly popular discriminant analysis model for knowledge based entities on the example of video game companies. Answering this question will allow a better understanding of the situation of entities of this sector and, by comparison, can be applied to other knowledge based economy entities. According to the early stage of research a formulation of hypotheses is abandoned. Because of its simplicity, the Polish video game sector has been chosen for the analysis. This sector is in an early stage of development and most of its entities are not engaged in other sectors. So result of these companies is directly related to its intangible source of value. The popularity of this sector among investors on the Polish capital market will also allow for the analysis of the discussed phenomenon in relation to the capital market, which will greatly facilitate answering the research question.

2. Financial Condition

Assessing financial condition of the company lays in a ground of a vast number of scientific papers and other studies.[1] Multiple discriminant analysis (MDA) is just one of many methods that an analysts can use. It makes it possible to predict the financial condition of economic entities. The result obtained in the calculated and presented models usually allows to determine whether a given entity is characterized by financial problems. These models are often used to assess the risk of bankruptcy [16, p. 251]. However, the result itself is only an assessment and is not a method of counteracting possible crises. The most popular example of discriminant analysis today is the first

model of this type used to analyse a threat of bankruptcy developed by E. I. Altman in 1968. It included five popular financial ratios, which in the form of a linear function allowed to distinguish entities in a distress situation from those which are not [16, p. 251]. For the 50th anniversary of its first publication the author published a work where he discussed a number of applications and possible extensions. He also concluded that despite the fact that some researchers have developed more advanced methods of predicting risk of default Z-score remains still popular due to its simplicity [1, p. 70], [2, pp. 1-2]. In 2017 Altman et al. tested the model and showed that it performed well on the international scale [3].

As the Polish video game sector has been chosen as an example for this study, the author has reviewed a current state of research in this field according to this market and its economic condition. A worth-mentioning work, is the one on MDA of Visegrad group countries in which authors develop their own models for enterprises of this region. They also show that the most significant predictors of bankruptcy are the levels of: current assets to current liabilities ratio, net income to total assets ratio, ratio of non-current liabilities and current liabilities to total assets, cash and cash equivalents to total assets ratio and return of equity [14]. All of them are a part of developed models.

Artur Paździor and Maria Paździor have analysed WIG-INFO[2] index companies, to which a two big video game companies belonged in the past. Their work was to "identify determinants of changes in market prices of shares of companies" [18, p. 156] included in this index which makes these considerations very similar to this study. The main part of their work is a correlation coefficient analysis in which they found out that rate of return of the companies is mostly related to: total debt ratio, index of the golden balance rule (equity/non-current assets), profit margin on sales, return on equity. Authors of the work also refer to the situation in which market price exceeds its book value and "goes beyond the traditional accounting framework" and gives examples of brand, distribution network, trade contacts and intellectual potential of employees [18, p. 157]. Assets related to knowledge are also a part of informatics sector and this work can broaden these conclusions. Relation of MDA models related to sector specific are a common topic of some researches. Jerzy Kitowski on example of WIG-MOTO[3] sector tried to verify the diagnostic reliability of discriminatory models [13]. He drew attention to the fact that the authors of the models do not focus on errors related to the selection of a test sample for an assessment of the probability of bankruptcy. Authors show that there are differences in "bankruptcy" criteria. In his analysis Kitowski stressed the fact that not all models take into consideration all categories of ratios, which additionally increases a risk of an incorrect diagnosis as the specificity of the analysed sector should be also take into consideration. Similar attitude is reflected in works of Sofie Balcaen and Hubert Ooghe [4] and Marek Gruszczyński [10]. The main problems are: the linearity assumption, use of annual accounts information, ratios with use of different components, neglecting the multidimensional nature of failure, methodological shortcomings, no reference to other methods present in the literature. However work of Edward I. Altman, Małgorzata Iwanicz-Drozdowska, Erkki K. Laitinen and Arto Suvas, summarized its verification of Z-score models with a statement that an influence of an age of the firm, its industry and country of origin is marginal. Because of that the original model performs well in an international context but "may be somewhat improved with country-specific estimation" [3, p. 167].

According to the setting of this work video games sector appears in works dedicated to financial condition only by its representatives among other examples. Kinga Olszewska and Tomasz Turek use example of CD Projekt and present only good results of this company with use of MDA as an information instrument used in financial condition of the company [17]. Among some other research the example of touristic sector can be useful. Nature of this sector is related to the prepaid character of service which affects the solvency of travel agents. Grzegorz Gołębiowski and Agnieszka Pląsek have analysed efficiency of discriminant models and concluded that the financial condition of travel agents is best described by: current liquidity, operating profitability, sales profitability, debt coverage ratio [8]. It is worth to refer to this result in case of video game sector in which the opposite situation takes place. Such companies spend relatively huge amount of money first, in order to get the results after introducing their product.

Another thread in MDA research is an assessment of their effectiveness. The results show that in more than 80% of cases financial problems could have been identified two years before bankruptcy [9]. However, despite such results, the quality of Polish bankruptcy models and the appropriateness of variable selection are rarely raised, as mentioned above [10]. Further research directions are focused on modifications and extensions, new variables and still testing models in different countries [3].

3. Methodology

Having reviewed the literature in search for some appropriate tools to answer the research question about the possibility of using discriminatory models to assess financial situation of the video game sector, there are some steps to be followed:

- distinguish and group financial ratios used to describe financial condition on the basis of selected discrimination models and literature review,
- analyse a possible impact of sector specificity on the level of these ratios,
- analyse the correlation of changes in these ratios with changes in the market price of shares of selected companies in the video game sector in the first days after publication of financial data – noticeable correlations will confirm the information value of a given indicator, making the models using them more valuable in assessment,[4]
- analysis of the results of selected MDA models – regardless of the results of the correlation analysis, a review of the values obtained from the selected models may allow to draw conclusions on the usefulness of this models.

Research sample

The 12 largest listed companies in the sector have been chosen to analyse the results of selected MDA models. The choice was done according to the Forbes report 'The largest Polish game producers. Polish gaming industry in 2018' for which financial data from quarterly reports for the last 3 years is available (data from Q4 2016; Techland, which is not a public company, and One More Level, which operated in another sector during the analysis, have been omitted). The data used for the analysis was obtained from the NOTORIA services (financial statements data) and stooq.pl website (stock market data).

MDA models chosen for a selection of ratios

On a basis of literature review the subjective choice of MDA has been done. The summary of selected models with its interpretation is presented in the table below.

Table 1. Summary of discriminatory distress prediction models.

Altmans' model (1968) and EM – score(1990)	$\text{Z-Score} = 1{,}2X_1 + 1{,}4X_2 + 3{,}3X_3 + 0{,}6X_4 + 1.0X_5$ $\text{EM-Score} = 6{,}56X_1 + 3{,}26X_2 + 6{,}72X_3 + 1{,}05X_4 + 3{,}25$	
	where: X1 – Working capital/Total assets X2 – Retained earnings/Total assets X3 – Earnings before interest & taxes/Total assets X4 – Market value of equity/Book value of total liabilities X5 – Sales/Total assets	Results higher than 5.85 correspond to a rating from BBB to AAA and results below 4.5 indicate significant financial problems.
ńs ka	$Z_M = 1{,}5X_1 + 0{,}08X_2 + 10X_3 + 5X_4 + 0{,}3X_5 + 0{,}1X_6$	

	where: X1 – (gross profit + amortization) /total liabilities; X2 – total assets /total liabilities; X3 – gross profit /total assets; X4 – net profit / revenues; X5 – inventories/ revenues X6 – revenues /total assets	Z_M<0 enterprise threatened with bankruptcy O<Z_M<1 company with a poor result, but not in danger of bankruptcy 1<Z_M<2 company in good financial condition Z_M>2 company is in very good financial condition
Poznański model (Hamrol et.al.)	$FD = 3{,}562X_1 + 1{,}588X_2 + 4{,}288X_3 + 6{,}719X_4 - 2{,}368$	
	where: X1 – net profit /total assets; X2 – (current assets – inventories) / current liabilities; X3 – fixed capital /total assets; X4 – profit on sales / revenues from sales	FD<0 bad financial situation FD>0 good financial situation
Hadasik model	$Z_{HA} = 2{,}36261 + 0{,}365425X_1 - 0{,}765526X_2 - 2{,}40435X_3 + 1{,}59079X_4 + 0{,}00230258X_5 - 0{,}0127826X_6$	
	where: X1 – current assets/current liabilities X2 – (current assets – inventories) / current liabilities X3 – total liabilities / total assets X4 – (current assets – short-term liabilities)/ total assets X5 – receivables / revenues X6 – inventories / profit on sales	ZHA<0 bad financial situation ZHA>0 good financial situation
Pogodzińska Sojak and model	$Z_{PS} = 0{,}644741X_1 + 0{,}912304X_2$	
	where: X1 – (current assets – inventories) / current liabilities X2 – gross profit / revenues	ZPS<0 bad financial situation ZPS>0 good financial situation. “grey zone” from -0,454 to 0,09

Source: own work on a basis of [6 p.147, 11, 21 pp.222].

4. Results

The first step of analysis was a selection and group of ratios used for assessing the financial condition. Table 2 presents all ratios in four groups covering main characteristics of the companies. The first group – profitability – presents the biggest number of ratios. It suggests that profitability is the most important part of a financial situation. On asset side of a balance sheet there is no information about the knowledge possessed by the company as well as reliable information on value of the production in progress. As not all assets are presented in the financial statement the profitability assessment in this aspect is out of reach. All nominators of the ratios in this sector are exposed to high variability depending on the video game production stage. Production process takes a few years and sales begins with the release of the game. In an early production stage the company may record low levels of these ratios, which cannot correspond to its true situation. Nevertheless, before any profits from sales occur, the company has to manage its costs wisely to reach the premiere day. This leads us to the liquidity where sectors characteristic is over-liquidity. To secure a long-term production process, companies accumulate large amounts of liquid financial resources. The situation is also hampered by differences in the recognition of expenditure on video games

influencing the structure of assets. Some companies classify this expenditure as inventories, some as intangible assets, which prevents comparability of liquidity ratios between companies [19]. For that reason a further analysis of other ratios based on levels of inventories was abandoned. The leverage ratios also depend on the sector characteristic where the significant part of passive side is taken by equity. High risk of production and uncertainty of results increases cost of external financing and influences the capital structure where a main role is given to equity. Summarizing, the sector's characteristics affect all of the areas analysed in this paper. Because of that, analysis of financial condition can be incompetent to decide about the company of this sector.

Table 2. Summary of variables employed in MDA models.

Profitability	**Liquidity**
1. EBIT / total assets 2. gross profit / revenues 3. gross profit / total assets; 4. net profit / equity 5. net profit / revenues; 6. net profit / total assets; 7. profit on sales / revenues 8. revenues / total assets	1. (current assets – current liabilities) / total assets 2. (current assets – inventories) / current liabilities 3. cash and cash equivalents / total assets 4. current assets / current liabilities 5. current assets / total assets 6. (gross profit + amortization) / total liabilities;
Leverage / Debt	**Others**
1. fixed capital / total assets; 2. retained earnings / total assets 3. total assets / total liabilities; 4. total liabilities / total assets 5. equity/ non-current assets	*1. market value of equity /book value of total liabilities* 2. receivables / revenues *3. inventories / profit on sales* *4. inventories / revenues*

Source: own work.

Second part of this work constitutes an analysis of the correlation between the selected ratios and changes of market valuations of these companies. If these ratios are meaningful for description of financial condition in the first days after release new financial data should be reflected by changes in market valuation of the company. Results presented in the Table 3 do not show a correlation between changes of analysed ratios and market valuation. A review of results for single companies often gives different correlations coefficients. For some of them relations of market valuation and profitability was positive (more than 0,7) and the same ratios for another company was negative (less than -0,4). Drawing conclusions based on that data is complicated. The video game sector has various relations so it could be stated that these ratios are not a basis for investment decisions of market participates or these changes were already in price before the release date.

Table 3. Correlation coefficient of changes of analysed ratios and changes of market valuation.

Ratios	+1 day	+2 days	+3 days	+4 days	+5 days
Profitability					
EBIT / total assets	0,08	0,10	0,10	0,10	0,11
gross profit / sales	0,00	-0,02	0,00	-0,01	0,03
gross profit / total assets;	0,00	0,00	0,03	-0,02	0,01
net profit / equity	0,05	0,12	0,12	0,06	0,07
net profit / revenues;	-0,04	-0,05	-0,04	-0,03	-0,03
net profit / total assets;	-0,04	-0,03	-0,03	-0,03	-0,04

profit on sales / revenues	-0,02	0,05	0,03	-0,01	0,00
revenues / total assets	0,09	-0,15	-0,17	0,06	0,06
Liquidity					
(current assets – current liabilities)/ total assets	**0,36**	0,00	0,01	0,12	0,11
(current assets – inventories) / current liabilities	0,09	0,12	0,09	0,04	0,00
cash and cash equivalents / total assets	0,07	-0,10	-0,11	0,06	0,05
current assets / current liabilities	0,11	0,10	0,06	0,05	0,00
current assets / total assets	0,05	0,05	0,03	0,00	-0,05
(gross profit + amortization) / total liabilities;	0,16	0,12	0,14	0,09	0,05
Leverage / Debt					
fixed capital/ total assets;	0,13	0,07	0,06	0,05	0,00
retained earnings/total assets	0,03	0,02	0,02	-0,09	-0,07
total assets /total liabilities;	0,09	0,11	0,06	0,05	0,05
equity/ non-current assets	0,01	0,08	0,06	-0,07	-0,05
Others					
receivables / revenues	-0,05	-0,05	-0,02	-0,14	-0,11

Source: own work based on NOTORIA and stooq.pl services data.

The analysis presented above is based on the efficiency of the market. As some information may be priced before the exact release of financial data, some longer periods have to be taken into consideration. Low levels of correlation coefficients should not be a strong basis of inference about the usefulness indicators used in the models. Table 4 presents a simple ranking of companies based on the three selected models. All of the models were positioned (1- lowest score, 12- the highest score) and their sum was calculated making a ranking. This ranking was also compared to a change in the stock exchange rate of companies over a period of four quarters until the end of June and the end of September 2019. This analysis of the results enables to put companies in order taking into account both the financial condition and the volatility of the market price of shares. It can be stated that models give useful information except companies such as:

- 11BIT, which recorded low and negative rates of return on shares despite relatively high levels of analysed models;
- ARTIFEX obtained the lowest result in the Mączyńska model, which suggests that in the two other models some ratios significant for this sector were omitted. The variability of the value of shares indicates the loss of half of the market capitalization in the analysed period;
- CI Games, which despite poor results describing its financial condition, obtained a stable result of changes in share prices on the market.

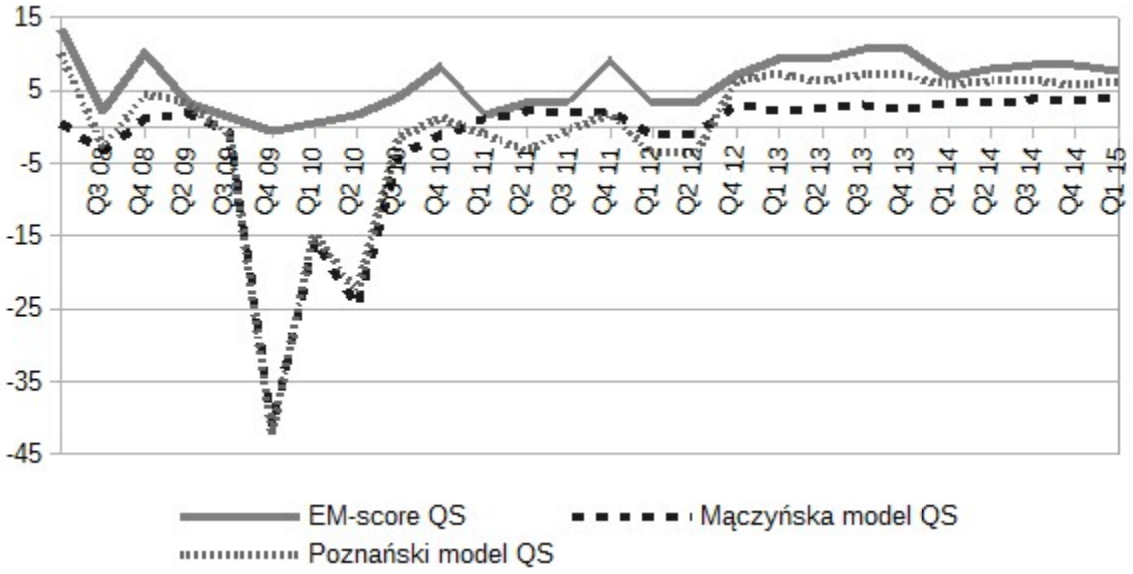
Table 4. Ranking of results obtained from selected discriminatory models for the analysed Polish video game sector companies.

	EM-Score		Mączyńska model		Poznański model		Ranking (sum of No.) [more =better]	Rate of return on stock market	
	Average of last 4Q results	No.	Average of last 4Q results	No.	Average of last 4Q results	No.		4Q to JUN 2019	4Q to SEP 2019
ULTGAMES	31,5	12	24,69	12	28,49	11	35	207%	61%
PLAYWAY	26,4	11	21,86	11	30,80	12	34	37%	34%
TSGAMES	18,5	10	20,88	10	13,12	7	27	79%	42%
11BIT	**16,8**	**8**	**13,61**	**9**	**20,48**	**9**	**26**	**-13%**	**16%**
CDPROJEKT	17,5	9	5,79	7	18,69	8	24	34%	31%
FORENTER	9,6	5	8,13	8	9,82	6	19	175%	214%
ARTIFEX	**14,4**	**7**	**-9,51**	**1**	**25,37**	**10**	**18**	**-43%**	**-53%**
BLOOBER	10,7	6	2,79	6	6,21	4	16	55%	66%
TBULL	8,0	3	1,75	5	4,70	3	11	-60%	-41%
FARM51	8,0	4	-1,45	4	6,32	5	13	-22%	-5%
CIGAMES	**5,4**	**2**	**-6,83**	**2**	**1,67**	**2**	**6**	**15%**	**2%**
VIVID	2,4	1	-2,34	3	0,47	1	5	-71%	-64%

Source: own work on a basis of NOTORIA and stooq.pl services.

These results of the analysis indicate a relatively satisfactory level of assessment, especially aimed at comparing the condition of various entities. Up to this point, the analyses were done to assess the situation of the companies. Only one of the companies listed in this sector has declared bankruptcy so far. This is Nicolas Games SA, bankruptcy history of which is centred between two dates. The first is February 2012, when the Nawar Company filed for bankruptcy. The second is June 2015, when the company's management board filed for bankruptcy. Figure 1 shows the variability of MDA models for this company clearly indicates that in 2013-2015 the situation was assessed as good by all three models.

Figure 1. Variability of results of selected discriminatory models for NICOLAS GAMES SA in the period from Q2 2008 to Q1 2015.



Source: own work on a basis of NOTORIA.

5. Conclusions

Discriminatory models are described in literature as not very widespread, but efficient and attractive analytical tools [16, p. 249] which, with relatively high reliability, they constitute the "basis for analysing the economic and financial condition of enterprises" [11, p. 21]. The research question in this paper was whether it is possible to use and correctly interpret popular discriminant analysis model for knowledge based entities on the example of video game companies. The answer to this question is not clear. Relations of main ratios used in MDA models shows that these indicators may prove worthless for analysis of this sector because of its characteristics. Also a correlation coefficients analysis of these ratios with market valuation does not show any significant relations. However, the ranking of results of selected models ordered companies relatively well with reference to long term market valuation trends.

In the analysed works a limited impact of financial and economic situation on the market price can be observed. This is caused by popularity of technical analysis [18] and some other factors including undisclosed assets and other information. Investors take into account other factors as shown in the market to book ratio analysis as well [20]. Also, Paździor and Paździor in their works suggest that financial situation of companies has a rather limited impact on the market price of their shares [18, p. 157]. This study shows some limitations mainly in assumption that investors make decisions based on an analysis of financial results. The second limitation is the lack of companies that have declared bankruptcy, so the model analysis focused only on ranking the results and not on the assess the risk of bankruptcy. The third limitation is imperfection of the research subject related to the imperfection of accounting policy. This translates into a large part of the problems with assessing profitability and liquidity. It remains to be determined whether this situation is more a limitation and whether the assumption to be made.

The inability to assess the entity's situation based on financial indicators, which is the case of video game companies, is an interesting phenomenon in the context of financialisation. The sector belonging to the most popular among stock market investors is not fully described by the tools available for a financial analyst. Further research in this field should consider the preparation of model on a basis of a subjective selection of companies in bad and good financial condition. Nevertheless, the in-depth research into the sources of financial condition in companies in this sector and other creative industries will significantly broaden the knowledge about the assessment of knowledge based companies.

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Notes

1. Quick look at main key words with use of Google Scholar search engine results with following number of publication: 4 820 000 for “financial analysis”, 4 540 000 for “financial condition”, 2 260 000 for “financial distress“; 601 000 for “z-score”(respectively also for results only from 2015: 1 420 000; 1 110 000; 195 000; 49 300).
2. WIG-INFO (informatics) is a sector index of companies listed on Warsaw Stock Exchange.
3. WIG-MOTO (automotive) is a sector index of companies listed on Warsaw Stock Exchange.
4. This assumption allows to conduct some basic research applying to a wide range of analysed companies. The use of correlation analysis may lead to incorrect results because before the publication of financial report expectations of market participants are already reflected in the price. The necessity to assess investors’ expectations before publication would require limiting the number of analysed entities and adding more assumptions related to evaluation of their predictions.

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Investments of Polish Family Businesses

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Abstract:
In this paper the authors address the issue of investments made by family businesses. Their study attempted to verify the level of investments made by Polish family businesses in comparison with the level of investments made by Polish non-family businesses. The study focused on the analysis of investment flows of Polish listed companies included in the WIG index for the years 2006-2018. A total of 233 companies were analyzed, including 177 non-family businesses and 56 family businesses. The results corroborated the argument that Polish listed non-family businesses invest much more money than family businesses. It was also observed that only a small percentage of companies in both groups invest their finances in research and development.
Keywords: family businesses, investments, research and development, non-family businesses.

1. Introduction

Over the years, family businesses have become a subject of interest for a growing number of researchers, scientists, economists and state decision-makers. This increased interest is motivated not only by the prevalence of family businesses in economies [4], but also from their unique character. "In the literature, family businesses have been presented as combinations of two systems that overlap and interact: the emotion-oriented family system that focuses on non-economic goals and the results-oriented business system that focuses on the economic goal" [23, p. 351]. The combination of these two different systems makes strategic decision making in family businesses extremely complex, and the decision-making process itself often differs significantly from that of

non-family businesses. Investment is one of the areas that may be affected by the specific ownership structure of family businesses. Making investments by business operators is crucial for the company to achieve a competitive advantage, develop or, in the long run, survive. And although the area of investment is so important for enterprises, so far little attention has been paid to this issue from the perspective of family businesses [17]. This is all the more surprising given that "investment might be a channel that helps explain the differential performance of the two types of businesses by focusing on strategic, long-term horizons" [6, p. 1035].

In view of the above, the authors decided to focus their study on the area of investments made by family businesses. They aimed at the verification of the level of investments made by Polish family businesses in comparison with the level of investments made by Polish non-family businesses.

The paper has been divided into three parts. The first part presents a review of the literature concerning the issue in question, including elements that may determine the difference between family businesses in terms of investment. The second part presents the data and methodology used in the study, and its results. The last part is a summary that concludes the work presented in the paper and points to issues that may contribute to further, in-depth analyses.

2. Literature Review

The discussion of family businesses often reveals that they are inherently conservative and with significant risk aversion [16], [5], [22]. Investment, and in particular R&D expenditure, is associated with uncertainty, which may discourage businesses from becoming active [11]. In every situation in which we are dealing with risk, there is a certain probability of success and failure. Failure can result from making a wrong decision or achieving a goal below expectations. The adoption of the *status quo* by companies, whether family or non-family, seems impossible nowadays [26]. So the problem to be addressed is whether family businesses invest, but they invest less than non-family businesses, or, perhaps, the ownership structure does not have any impact on the activity in this area.

In the vast majority of the literature, which somehow raises the issue of family businesses and their financial decisions, two basic factors that may influence the uniqueness of family businesses in terms of investment are given:

- family risk preferences,
- family horizons.

2.1. Family Risk Preferences

Family businesses certainly perceive the risk of a given situation differently than non-family businesses. This may result from the fact that families are often directly linked to the assets of the company. Secondly, families are also emotionally linked to their companies. The relation between assets and the company results from the fact that the owner and other family members hold significant shares in the company. As a result, the company's assets are a family assets and its survival directly affects the family's well-being [5], [2]. The emotional connection, in turn, results from the very personal treatment of the family business, especially by the founders, who see their work as another "child" [25], which must be maintained and developed without taking unnecessary risks that could in any way endanger prosperity. "Business owners and their family members working in family businesses very often work as volunteers themselves – not counting the time spent in business" [25, p. 47]. The issue of trust and favouritism, often referred to as nepotism, also arises in place of an emotional relationship. It often happens that the owner prefers to employ a less educated family member than a person from outside. This procedure is even more visible in succession processes, when it becomes more important to keep the company in the hands of the family than finding a competent successor [6]. Keeping the company in the hands of the family is at the same time one of those factors that may induce the family business to undertake activities

characterized by above-average risk. Risky activities, characterized by a high probability of failure, will be more often undertaken by family companies than non-family ones if these activities make up a chance to keep the company in the hands of the family. The above discussion allows us to state that "family businesses are risk willing and risk averse at the same time because a prime motivation of owners is to preserve their socioemotional wealth" [14, p. 134]. It seems, therefore, that different motives governing family businesses may balance aversion and willingness to risk.

The general investment tendency of family businesses is confirmed by the research conducted by Ronald C. Anderson and David M. Reeb [1], who analyzed S&P 500 companies in the period 1992-1999 and showed that family businesses have a higher Tobin's q-ratio[1] and achieve better results than non-family businesses. At the same time, by examining the tendency of companies to incur expenses on research and development Ettore Croci, and colleagues [11] showed that family businesses engage less capital in R&D and risky investments than non-family businesses (survey on European companies in 1998-2008). The same conclusions were reached by Fernando Muñoz-Bullón and Maria J. Sanchez-Bueno [24] who surveyed Canadian listed companies in the period 2004-2009 and Joern H. Block [7] who verified the behavior of family listed companies included in the S&P 500 index. An interesting perspective of the problem perception was presented by James Chrisman and Pankaj Patel [9] who proved that family businesses invest less in research and development, but are able to increase their expenditures on this objective to a greater extent if the results achieved are lower than the aspirations of the owners.

2.2. Family Horizons

In their research on family businesses Renato Tagiuri and John A. Davis [29] showed that 80% of the population they surveyed considered long-term survival to be an important goal, and 44% a major goal, and although a long time had passed since the survey, this preference seems to have been widely recognized and accepted in the literature. Longevity, the transfer of the company to the next generation, is the perspective that family businesses face. For many companies, ensuring the longevity of a company is more important than maximizing profit or continuously increasing profitability [17]. Investing "with a long-term perspective, possesses strong incentives to engage in investment activities that ensure the long-term viability and health of the firm" [3, p. 1746]. This means that family businesses will be very cautious about investing and will assess emerging investment opportunities not only from the perspective of profitability, but also, and above all, from the perspective of business continuity.[2] This eliminates the myopia of which external managers seeking to maximize short-term profits in order to obtain higher remuneration are often accused [3]. According to Thomas Zellweger [32], a long-term approach means that there are two strategies that family businesses can follow in their investment activities. As the marginal investment risk decreases over time, "long-term-oriented businesses can invest in projects with equal risk, but lower returns compared to the short-term investor" [32, p. 9] or "long-term-oriented businesses can invest in projects with equal returns but higher risk compared to the short-term investor" [32, p. 9]. It all depends on how much risk the owner is willing to accept. Another issue that researchers point out in the case of family businesses is the ability to pass on knowledge from generation to generation [6]. Several-century-long accumulation of secret recipes, know-how or specialist knowledge allows family businesses to take action aimed at research and development. In the literature one can even come across the notion of innovative potential of family businesses in the aspect of knowledge diffusion [18].

An interesting study on longevity issues was conducted by Suzanne Landry, and colleagues [20], who proved that family businesses in which a family member is the owner and direct manager of the company prefer to acquire assets in order to accumulate wealth and pass it on to future generations, while family businesses, where the founder is the only member of the family involved in business, opt for the lease of assets. The willingness and perspective to transfer the company to the next generation motivates the owner to accumulate wealth for ownership. The above may suggest, however, that family businesses will invest, but to a large extent in fixed assets rather than

research and development. This view is distorted by the study conducted by Shou-Min Tsao and Wei-Hao Lien [30], who, when analyzing publicly listed Taiwanese companies for the period 2000-2009, proved that there is a statistically significant, positive correlation between family businesses' R&D spending and internalization. Such a correlation does not exist in the case of non-family businesses. Expansion into foreign markets fits in perfectly with long-term strategies, and increased spending on R&D suggests that in the long run, companies are able to take risky actions if they contribute to the development and maintenance of a family business.

The literature review presented in this section clearly shows that the issue of investment by family businesses is extremely complex and complicated, and the results of the research are heterogeneous. Due to the unique nature of family businesses, many situations or factors can be seen in different ways, which means that the actual decisions of family businesses may differ from theoretical assumptions. Taking into account the above and the fact that, to the best of the authors' knowledge, there are no sources that comprehensively and exhaustively treat the investments of Polish family businesses, a decision was made to analyze the phenomenon.

3. Data, Methodology and Results

In order to achieve the main goal of the paper, the authors conducted a survey on Polish listed companies based on data obtained from the Notoria database for the years 2006-2018. The survey used the information contained in cash flows. The cash flow approach, in comparison to the more frequently used balance sheet approach, is a great advantage of the survey, because it allows for accurate tracking of the movement of the company's cash resources during the period in which they took place. In addition, the cash flow statement details the category of investment, allowing real changes to be observed over the years.[3]

The companies included in the WIG index according to the yearbook published by the WSE in 2019 [15] were selected for the survey. In total, 346 companies are listed in the yearbook. After excluding foreign companies, companies with a fiscal year not equal to calendar year, companies with incomplete data and companies from the financial sector (active in investment, brokerage, insurance, and liabilities), as many as 233 companies remained to be analyzed.

The group of companies identified as described above was divided into two categories: non-family listed businesses and family listed businesses. Definition of what make a business a family business was the fundamental issue at the stage of dividing a given population into the indicated categories. Determination of the family structure of a given company has posed problems for researchers ever since they started dealing with family businesses, which have a specific ownership structure [27], [10]. However, in accordance with the approach already developed by the authors,[4] for the purposes of this study, family businesses were considered to be those in which:

- at least one member of the family or a family together holds at least 33% of the votes in the company,
- at least one member of the family is a member of the company's board of directors or supervisory board,
- the company has all the features of a family business.

Eventually, 177 companies were identified as non-family businesses, and 56 companies were identified as family businesses. The companies selected belonged to different sectors and achieved different levels of sales revenues. Therefore, in order to verify the comparability of the two groups, their average size was calculated by logarithmizing the sales revenues generated by the companies in 2018. Based on the results obtained, it was concluded that the groups under examination are comparable, as their average size differs insignificantly[5]. The results are presented in the table below:

Table 1. Size of companies in the groups under analysis.

Natural logarithm from sales revenues in 2018 in TPLN				
average	**standard**	**median**	**min**	**max**

		deviation			
Non-family businesses	11.92	2.43	12.03	1.10	18.28
Family businesses	12.04	2.03	12.31	4.50	15.83

Source: prepared by the authors based on the data in the Notoria database.

The next step in the analysis was to verify the level of investment cash flows of companies over the years. Using annual cash flow statements, lists were prepared in which the average level of investments was calculated for each year. The number of companies analyzed in particular years is not constant, which is due to the fact that some companies entered the main market of the WSE later.

The data revealed that in the years 2006-2018, the flows are negative in each year, i.e. the companies invested more than they sold their accumulated assets. However, the difference in the level of investment is very clear. Non-family businesses invested much more than family businesses – on average, investment flows of non-family businesses were six times higher. This dependence does not occur in 2011 only, when family businesses had on average a higher level of investments (non-family businesses: -14,817.88 thousand zlotys and family businesses: -69,309.00 thousand zlotys). However, this deviation results from several anomalies, such as: in the group of family-owned companies – a one-off significant increase in expenses of Cyfrowy Polsat S.A.[6] and in the group of non-family businesses – significant divestments of several large companies.[7] All in all, the above situation resulted in a disturbance of the sample. Therefore, the authors made a partial adjustment, excluding Cyfrowy Polsat S.A. from the set of family data of listed companies. The adjustment of the sample smoothed out the cash flows (change in the volatility ratio from 65.63% to 35.54% compared to 32.24% for non-family businesses) from -11,274.58 thousand zlotys to -34,207.56 thousand zlotys. It is worth noting, however, that in 2011, even after the adjustment, the investment flows of family businesses were higher.

Table 2. Average investment cash flows of non-family and family businesses – comparison.

Data in TPLN	2006	2007	2008	2009	2010	2011	2012
Investment flows non-family businesses	-113,383.67	-90,923.71	-112,960.28	-101,174.75	-117,457.96	-14,817.88	-150,970.83
Investment flows family businesses	-13,342.90	-34,510.74	-33,763.05	-13,445.33	-15,358.56	-69,309.00	-7,168.08
Investment flows family businesses without Cyfrowy Polsat	-12,965.59	-34,207.56	-33,283.61	-12,323.44	-14,076.87	-18,180.92	-11,274.58
Data in TPLN	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	
Investment flows non-family businesses	-59,464.04	-107,312.75	-105,544.07	-94,788.10	-82,107.51	-97,714.27	
Investment flows family businesses	-14,858.58	-34,005.81	-13,989.54	-11,807.26	-27,513.69	-26,022.23	
Investment flows family businesses without Cyfrowy Polsat	-16,951.88	-19,905.92	-18,631.94	-18,411.03	-22,733.94	-24,904.45	

Source: prepared by the authors based on the data in the Notoria database.

A thorough analysis of the potential causes of such large differences in the level of investment flows between the two groups revealed an interesting phenomenon – family businesses are often not present in the sectors[8] where non-family businesses are present. Sectors which in most cases do not include Polish listed family businesses are very capital-intensive, e.g. industrial construction, distribution of fuels and gas, power engineering, renewable energy, metal mining, coal mining or extraction and production. It seems that capital necessary for the operation of this type of enterprises is the barrier to the presence of family businesses in these sectors; due to their short history family businesses have not yet managed to accumulate sufficient capital (Polish family businesses are usually only before or in the phase of the first succession [21]).

Taking into account the above, it was decided to carry out an additional analysis, which included enterprises from the same sectors in both groups. The application of the additional restrictive condition resulted in the inclusion of 133 companies from 26 different sectors[9] in the population surveyed, including 84 non-family listed companies and 49 family listed companies.

Due to the change in the number of particular groups, it was decided to verify their comparability again by analyzing the average size of companies. The results obtained allow us to conclude that the samples were perfectly matched in terms of size, as the difference between the average for non-family businesses and family businesses is only 0.07. The results are presented in the table below.

Table 3. Size of enterprises in the groups under analysis after adjustment of sectors.

	Natural logarithm from sales revenues in 2018 in TPLN				
	average	**standard deviation**	**median**	**min**	**max**
Non-family businesses	11.99	1.89	12.09	7.13	16.51
Family businesses	11.92	2.06	12.12	4.50	15.67

Source: prepared by the authors based on the data in the Notoria database.

Similarly, as in the first case, the next step was to create a list of the average level of investment flows for groups of companies in the years 2006-2018. Due to the fact that Cyfrowy Polsat S.A. remained in the group of family businesses, the study was conducted both before and after its exclusion.

As in the case of the first analysis, larger investments were made by non-family businesses, with a deviation in 2011, however, the existing differences are smaller. Due to the exclusion of Cyfrowy Polsat S.A., throughout the entire time series, non-family listed companies have invested more than family businesses. On average, investment flows of non-family businesses were three times higher and their level ranged from -38,228.05 thousand zloty to -59,355.56 thousand zloty. The coefficient of variation for non-family businesses was 24%, and for family businesses 73% (after the exclusion of Cyfrowy Polsat S.A. it was 37%).

Table 4. Average investment cash flows of non-family and family businesses - after sector adjustment.

Data in TPLN	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Investment flows non-family businesses	-59,355.56	-66,706.93	-58,149.74	-56,864.67	-48,215.28	-45,815.10	-56,272.05
Investment flows family businesses	-14,929.15	-34,779.00	-36,730.79	-12,465.64	-16,666.88	-78,779.27	-6,853.78
Investment flows family businesses without Cyfrowy Polsat	-14,554.92	-34,432.79	-36,268.64	-11,123.43	-15,225.65	-20,400.01	-11,513.12
Data in TPLN	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	
Investment flows non-family businesses	-38,228.05	-38,284.06	-54,156.04	-84,446.97	-42,761.61	-39,655.05	
Investment flows family businesses	-16,461.74	-33,901.15	-13,148.67	-8,056.79	-28,753.68	-26,431.12	
Investment flows family businesses without Cyfrowy Polsat	-18,869.78	-17,653.35	-18,464.59	-15,545.47	-23,302.71	-25,158.85	

Source: prepared by the authors based on the data in the Notoria database.

As indicated in the literature review, in addition to a general verification of the level of investment flows, it is also worth analyzing R&D spending, as it is perceived as more risky [19] and necessary for a company to supply new products or services to the market and remain competitive [7].

Therefore, in the groups under analysis adjusted by sector, lists presenting average R&D expenditures in the years 2006-2018 were prepared. For non-family listed companies, the average level of R&D expenditures ranged from -6,600,000 zloty to -38,142,000 zloty, with the first flows in the surveyed group appearing only in 2010. In the case of family businesses, average R&D expenditures ranged from -5,271,000 zloty to -29,134,000 zloty, and the first R&D flows appeared as early as 2007. It follows from the above that the difference between the groups under study is much smaller in the case of R&D expenditures than in the case of total investment flows.

It should be noted at the same time that the amounts specified above in the case of non-family businesses were invested over the years only by 4 companies, one each from the mechanical equipment, games, medicines, and IT systems sectors, and in the case of family businesses by 2 companies, i.e. one from the electrical equipment and one from the games sector. The above results

allow us to conclude that few Polish listed companies allocate funds to research and development, regardless of its ownership structure.

Table 5. Average expenditure on research and development of non-family and family businesses - comparison after adjustment of sectors.

Data in TPLN	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
R&D expenditure by non-family businesses					-6,600.00	-1,772.00	-8,200.00
R&D expenditure by family businesses		-5,271.00	-9,228.00	-8,168.00	-9,641.00	-16,957.00	-27,423.00
R&D expenditure by family businesses without Cyfrowy Polsat		-5,271.00	-9,228.00	-8,168.00	-9,641.00	-16,957.00	-27,423.00
Data in TPLN	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	
R&D expenditure by non-family businesses	-4,000.00	-4,144.50	-20,512.33	-24,727.00	-29,322.33	-38,142.00	
R&D expenditure by family businesses	-29,134.00	-27,076.00	-11,276.62	-16,075.00	-13,541.00	-14,302.50	
R&D expenditure by family businesses without Cyfrowy Polsat	-29,134.00	-27,076.00	-11,276.62	-16,075.00	-13,541.00	-14,302.50	

Source: prepared by the authors based on the data in the Notoria database.

4. Conclusion

The aim of this study was to verify the level of investments made by Polish family businesses in comparison with the level of investments made by Polish non-family businesses. The analysis was conducted on data obtained for Polish listed companies for the years 2006-2018.

The results revealed that Polish listed companies invest more than they sell their accumulated assets, because over the years the average investment cash flows were negative. At the same time, non-family businesses had a higher level of investment flows than Polish family businesses. This relation proved true for the analysis made before and after the adjustment of sectors. Additionally, the verification of the level of expenditures of family and non-family businesses on research and development does not help to clearly determine the group, which invests more in this area. Both in the group of non-family businesses and in the group of family businesses, the number of companies investing in R&D did not exceed 5% of the total number of companies in a given category.

In the light of the study carried out, can the myth of family businesses as conservative companies and those characterized by aversion to risk be disproved? Certainly not. Nevertheless, the analysis presented above showed that family businesses "often face paradoxes such as balancing traditions from the past while keeping up with innovation and change, or the question of family liquidity versus business growth" [13, p. 4].

At the same time, as indicated by Joanna Sadowska [26], the fact that the level of investments of all Polish companies is low, especially in this most innovative area, i.e. research and development, is worrying. Regardless of the ownership structure owned by the company, the level

of expenditure on research and development, as well as the number of companies that decide to allocate capital to this area is very small. Perhaps, therefore, the thesis put forward by George Tanewski, and colleagues [31] that the greatest impact on investment activity of both non-family and family businesses has a strategic orientation, i.e. the type of implemented strategy, is true. In the case of Polish family businesses, it can also be assumed that the low level of investment results from the upcoming wave of succession, which is just beginning in the Polish economy. It seems reasonable that the doyen will limit investments before the succession, because the uncertainty connected with this process makes increased investment uneconomical.

This issue, however, goes beyond the area of this article, while encouraging the authors to conduct further, in-depth study on the subject of family business investments. It seems that the identification of specific micro- and macro-economic factors influencing the investments of companies in different economies could be the basis for an attempt to answer the question whether the ownership structure is the real determinant differentiating the investment expenditures of family and non-family businesses.

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Annex 1
List of sectors after group adjustment

No	Sector	Non-family businesses	Family businesses
1.	every day use goods	2	1
2.	general construction	2	2
3.	games	7	1
4.	hotels and restaurants	2	1
5.	iron and steel metallurgy	5	1
6.	construction and telecommunication installations	2	2
7.	civil engineering	2	2
8.	building materials	8	4
9.	clothes and shoes	3	6
10.	paper and packaging	1	2
11.	manufacture of medicines	5	1
12.	recycling	1	1
13.	sale of real estate	7	4
14.	electrical and electronic equipment	1	1
15.	IT hardware	1	1
16.	IT systems	5	1
17.	telecommunication	2	1
18.	transport	3	1
19.	plastics	2	1
20.	electrical equipment	6	2
21.	mechanical equipment	5	4
22.	services for enterprises	3	1
23.	publishing house	1	2
24.	metallurgical products	2	1
25.	metal products	2	1
26.	food	4	4

Source: prepared by the authors.

Notes

1. More about Tobin's q-ratio in [8].
2. It is coherent with the conclusion presented in Section 2.1. Family businesses are focused not only on the profitability but also or maybe in some cases primarily on the long-term business survival; hence they are unlikely to undertake risky investment projects. However, if there is a risk of losing control over the company (for instance through a hostile takeover), then to avoid this, the family business will be able to take action at above-average risk.
3. Another study on the Polish market, known to the authors, was conducted on the basis of balance sheet data [26].
4. For the purposes of other publications, the authors have developed a definition of a family business, which they use in their research. For details, see [28].
5. The Authors are aware that more in-depth analysis concerning the relation between investment and assets would be valuable, therefore this is the area of subsequent research.
6. In 2011, Cyfrowy Polsat S.A. acquired 100% of shares in Telewizja Polsat, which resulted in an increase in cash flows from investing activities from PLN -74,316 thousand in 2010 to PLN -2,473,859 thousand in 2011 [12].

7. In 2011, PKN Orlen S.A. had total investment flows of PLN 2,490,678.00 thousand, and in 2010 - PLN 2,568,977.00 thousand. A similar situation was observed in PGE S.A., cash flows in 2010 at the level of PLN -3,547,228.00 thousand and in 2011: PLN 4,120,181.00 thousand and KGHM S.A: in 2010, investment flows at the level of: - PLN 3,125,246.00 thousand and PLN 3,590,000.00 thousand in 2011.
8. Information about sectors was taken from the Notoria database.
9. The list of sectors is given in Annex 1 to the article.

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Financial Factors Influencing the Development of Product Innovations in Polish Small and Medium Enterprises

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Abstract:
The development of product innovations in small and medium enterprises is determined mainly by their financial capabilities. These enterprises usually encounter financial problems when it comes to the introduction of product innovations. Therefore, managers should manage the company's finances in the way that will enable them using all available means to solve these problems. This means that they ought to use external financial resources to a greater extent (not only in the form of loans). The article focuses on the financial conditions for the development of product innovations in small and medium enterprises, while other forms of innovation are omitted. Product innovations are given the highest priority by mentioned companies. The analysis covered the years 2010-2017. The case study allowed to present changes in this most important form of activity for enterprises in the SME sector during the analyzed period[1]. In the article there were used data published by GUS, NBP, PARP, Eurostat. The article presents the following thesis:
The innovative activity of Polish enterprises takes mainly the character of product innovations, which often require large financial outlays. Two hypotheses were used to verify the thesis: HPT1: The increase in the outlays of enterprises on technical progress and on research and development works (R&D) leads to the development of product innovations. HPT2: The companies' own resources are the main source of financing for product investments. Due to the greater capacity of large companies to spend on R&D, they are more active in product innovation than small companies, whose financial resources are significantly limited. Broader implementation of product innovations in SMEs requires wider access to finance and greater involvement of many participants. In order to be able to take advantage of all possible opportunities to renew the production programme, the company should ensure appropriate internal and external integration in the management of the process.
Keywords: product innovations, research and development (R & D), financing.

1. Introduction

In the article I focused on product innovations, which are mainly determined by the enterprises' outlays on research and development (R&D). Maintaining economic and financial balance in the long term requires the company to be constantly active in implementing product innovations. This systematic renewal of the production programme has a strategic dimension and should be correlated with the life-cycle phases of existing products. This has a significant impact on the profit formation. This is particularly important because small and medium enterprises in Poland mostly use their own financial resources for this purpose. Therefore, the development of product innovations in such conditions requires a systematic approach to research and development (R&D) field.

The organisational culture of enterprises and constant mobilisation of financial resources is an important basis for potential product innovations [6, pp. 167-173], [9]. It is important, firstly, that these companies do not limit themselves to own resources, but also make greater use of external financial resources (not only in the form of loans). Secondly, they should not use only internal sources of innovation, but ought to also be more active in searching for external sources in their innovation strategies. Innovation in introducing new products/services is a process involving numerous participants, therefore it requires a high degree of integration inside and outside the enterprise.

2. Product Innovations as a Basic Form of Innovative Activity of Small and Medium Enterprises

In economic literature, the concept of innovation refers to any change and introduction of novelty or idea. There are many definitions of innovation. The first of them focused on the technical aspect of innovation, the essence of which, according to authors such as Joseph Schumpeter, is a significant change in the function of production, consisting in a different than before combination, i.e. merging factors of production [36, p. 104]. Also for the authors of the first edition of the Oslo Manual, this technical aspect of innovation was the most important. In subsequent editions of the Manual, this innovation formula was extended beyond its technical aspect and such types of innovation as process, organisational and marketing innovations were identified [31].

Peter Ferdinand Drucker also gives a more general definition of innovation, pointing out that it is a special tool for entrepreneurs, which is used to turn a change into an opportunity to start a new business or to provide new services. According to Drucker, it is important that the work is properly organised. In order to avoid randomness and to ensure rationality and regularity in innovation matters, it is necessary to manage this process in such a way as to make use of all possible opportunities [4, p. 129]. Also Genrich Altshuller represents the wide approach to innovation [1]. He believes that '...innovation is a complex phenomenon involving a set of skills, a distinct way of organising, synthesizing and expressing knowledge, perceiving the world and creating new ideas, perspectives, reactions and products' [1, p. 21].

Currently, the definition proposed by the OECD is widely used, which specifies '...innovation as the introduction of new or significantly improved goods (goods or services), processes, marketing and organizational methods, changes in relations with the environment or work organization' [31].

Product innovations are mainly determined by the outlays of enterprises on technical progress and on research and development (R&D). The same is also true for process innovations. However, in organisational and marketing innovations this relation is no longer so unambiguous and obvious.

According to the Oslo Manual 2005 '... a product innovation is the implementation of a good or service that is new or significantly improved in terms of its functional characteristics or intended uses'. [31] This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics [31].

Product innovations may exploit new knowledge or technology or be based on new applications or combinations of existing knowledge and technology. Although design is an integral

part of the development and implementation of product innovations, its slight changes alone cannot be considered as innovations. They must significantly change the functional characteristics (technical parameters) or the use of the products. Otherwise these changes can be considered as marketing innovations. Marketing innovations also occur when a company uses a season change to make major design changes as part of its new marketing strategy.

It should be stressed that the sale of goods which are innovations from the point of view of an industrial enterprise is not an innovation for companies dealing with their trade, transport and warehousing. In the case of these companies we deal with innovations-products only when they start to sell, transport or store products from a new line of goods, i.e. types of goods that these companies did not deal with before, and introducing them means offering a new service [27, p. 169], [31].

Process innovations mean the implementation of a new or significantly improved production or delivery method. Significant changes in production can occur in technology, hardware and software. Process innovations may be aimed at reducing the unit costs of production or supply, improving quality, producing or supplying new or substantially improved products.

Marketing innovations occur when a company introduces significant changes in a product, its price, promotion and distribution (4P). Changes in marketing instruments and activities mean the introduction of a new marketing method, provided these are the first uses of the company concerned. Marketing innovations are to lead to the opening of new markets or a new positioning of the company's product on the market to increase sales.

Organisational innovation means the implementation of a new organisational method within the company's operating rules, in the organisation of the workplace or in relations with the environment. The aim of organisational innovation may be to achieve better results by reducing administrative costs or transaction costs, increasing the level of work satisfaction (and thus work efficiency).

It should be stressed that organisational change does not necessarily mean only a response to a technical change, but may be a necessary precondition for a technical innovation. Organisational innovations are not only a factor supporting innovation in products and processes, but can also have a significant impact on the efficiency of companies. The aim is to improve the quality and productivity of work and the company's ability to learn and use new knowledge and new technologies.

Every product innovation has its source. They can be internal and external. We can also adopt a different criterion of division distinguishing product innovations in terms of demand and supply [23, p. 48].

Internal (endogenous) sources of innovation are those inside the company; they include, among others, the work of our own research and development department, creative and talented employees, management staff and pro-innovative organisational culture. External sources are based on information collected from the market environment of customers, suppliers, competitors. These include primarily: research cooperation with research and development institutions, results of work of domestic and foreign research and development units, purchase of licenses and know-how, and joint scientific undertakings.

Only the use of both internal and external sources of innovation by entrepreneurs allows the integration of internal and external knowledge, which creates the conditions for optimal use of many product innovation paths. Many specialists, including Henry Chesbrough – the creator of the open innovation model – express the view that sources of innovation cannot be limited only to R&D departments in an enterprise, but the whole environment of the company should be taken into account [3, p. 17].

Such a broad approach to the roots of innovation was used by Drucker to identify demand and supply sources [4]. First of them include unexpected changes in the market or industry. The importance of the customer as an active participant in the innovation process through the search for new product concepts should be highlighted here. We are talking then about innovations 'drawn by the market'. Numerous research studies provide strong arguments indicating that the active

participation of customers in the development of an innovation strategy allows for the implementation of better new products.[2]

In both the financial perspective 2007-2013 and 2014-2020, the European Union has set itself the goal of developing the R&D sector and creating conditions for rapid development of innovation and competitiveness of enterprises. This has been identified as a priority which requires, as the new Europe 2020 plan states, an increase in R&D spending to at least 3% of EU GDP [15].

On 7 June 2018, the European Commission launched the new 'Horizon Europe' programme, which is based on the success of the 'Horizon 2020' programme. EUR 100 billion was allocated to it for the years 2021–2027 [20]. The Innovative Economy Operational Programme has been replaced by the Smart Growth Operational Programme [15].[3]

One of the effects of using EU funds, apart from the development of R&D activity directly in enterprises, is the creation of modern infrastructure contributing to effective technology transfer between the scientific sector and business, cooperation within the supply chain (clusters), as well as the development of modern technological thought (e.g. Technology Parks – PT, Technology Transfer Centres – CTT, Clusters).[4]

3. Shaping of Enterprises' Expenditure on R&D and Effects in the Form of Implemented Product Innovations in Poland

The development of product innovations in enterprises is evidenced mainly by their activity in the R&D sphere, which is not directly related to the creation of a specific innovation, but is inscribed in the DNA of the enterprise.

Analysing only the enterprise sector, it should be stressed that the main source of financing R&D activities by enterprises are their own resources and resources from the state budget. In particular, the following sectors develop in the context of R&D activity: automotive, aviation, electronics, telecommunications, IT, biotechnology and biochemistry, medical and pharmaceutical engineering, robotics and nanotechnology construction. The development of outlays of enterprises on R&D activity in relation to total outlays and in relation to GDP in % in the years 2010-2017 is presented in Table 1.

Table 1. Shaping of enterprise expenditures on R&D activity in relation to total expenditures and in relation to GDP in % in the years 2010-2017.

Specification	Years							
	2010	2011	2012	2013	2014	2015	2016	2017
Total internal expenditure on research and development (in millions of PLN)	10 733	11 679	14 353	14 424	16 168	18 061	17 943	20 578
% increase/decrease in relation to the previous year	+8.5	+8.8	+22.8	+0.01	+12.1	+11.7	-0.07	+14.7
Enterprises' expenditure (in millions of PLN)	2 770	3 520	5 354	5 611	8 892	10 836	11 663	13 520
% share in total	25.8	30.1	37.3	38.9	55.0	60.0	65.0	65.8
% increase/decrease	+8.2	+27	+52.1	+4.8	+58.5	+21.7	+7.6	+15.9

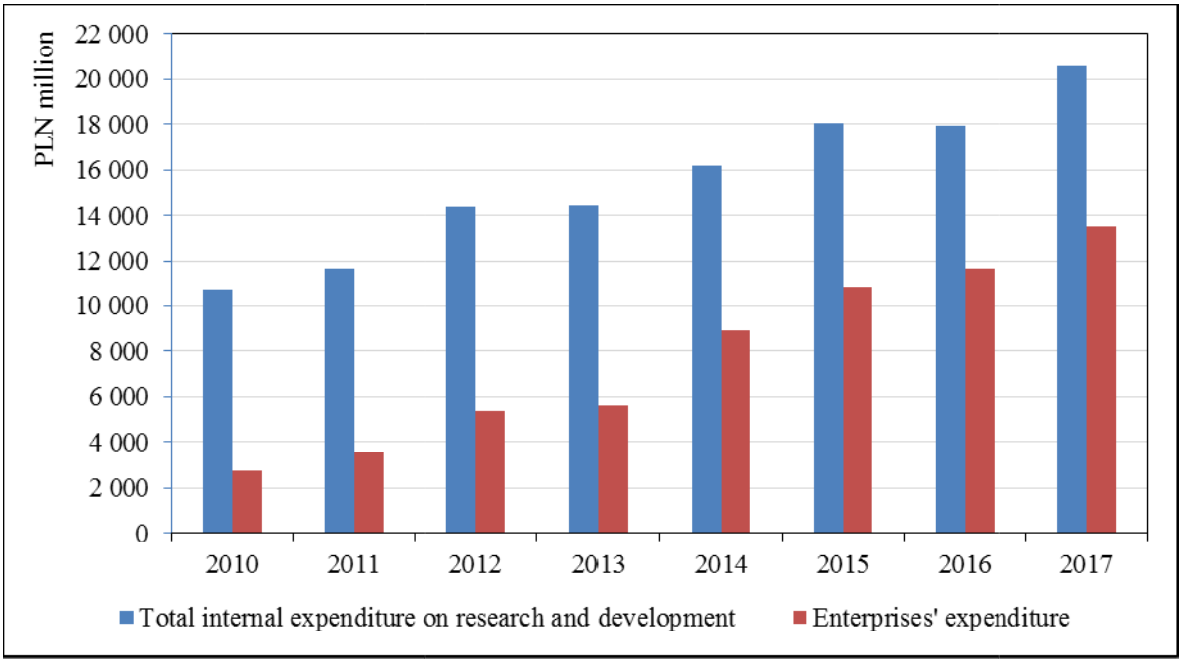
in relation to the previous year								
Internal R&D expenditure to GDP ratio in %	0.72	0.75	0.88	0.87	0.94	1.00	0.97	1.03

Source: Own study based on data from [11], [12], [13], [18], [22].

In the analysed period internal expenditures of enterprises on R&D activity increased from 0.72% of GDP to 1% of GDP.[5] However, they are still insufficient, although the average annual growth rate of internal R&D expenditures of enterprises in 2010-2017 amounted to 26.8%.

Chart 1 shows the development of R&D expenditures of enterprises in relation to total expenditures in the years 2010-2017 (in PLN million).

Chart 1. Shaping of enterprise expenditures on R&D activity in relation to total expenditures in 2010-2017 (in PLN million).



Source: Own study based on data from [11], [12], [13], [18], [22].

Expenditures on R&D in Poland are systematically growing and it is assumed that in 2020 they will constitute 1.7% of GDP. The large increase in R&D expenditures assumed for 2020 still leaves our country on a distant position in relation to not only the leaders, but also those countries with average expenditures.[6]

The figures for the purchase of licences, R&D, automation measures and foreign licences are presented in Table 2.

Table 2. Number of enterprises that purchased licenses, research and development works, automation measures from Poland and the European Union and number of foreign licenses in 2010-2016.

Specification	Years 2010 – 2016							Change 2010-2016 (%)
	2010	2011	2012	2013	2014	2015	2016	

Number of enterprises that purchased licenses: from Poland from EU	1244 318	712 230	878 259	675 239	889 233	724 215	911 217	-27 -32
Number of enterprises that purchased research and development from Poland from EU	464 133	327 83	399 114	367 109	429 117	318 113	421 95	-9 -28
Number of enterprises that have purchased automation measures from Poland from EU	896 599	709 478	821 593	634 489	715 440	519 383	640 363	-28 -39

Source: Own study based on data from [11], [12], [13].

In 2010-2016, very unfavorable indicators were noted in relation to purchases: licenses (-27 and -32%), research and development works (-9% and -28%) and automation measures (-28% and 39%). However, it should be stressed, that the number of entities involved in R&D is systematically increasing in Poland. Thus, in 2017 there was an increase by almost 5%, and the number of R&D personnel increased by almost 12% [13].

Table 3 presents the percentage share of companies that introduced product innovations in the years 2011-2013 and 2014-2016 in particular groups.

Table 3. Share of companies that introduced product innovations in the years 2011-2013 and in the years 2014-2016 in particular groups.

Specification	Companies that have introduced product innovations	
	Years	years
	2011 - 2013	2014 - 2016
	%	%
Industrial companie, in which:	**11.0**	**12.4**
Number of employees: 10-49	6.1	**7.1**
Number of employees: 50-249	21.1	21.9
Number of employees: 250 and more	42.7	44.2
Service sector companies, in which:	**5.8**	**6.4**
Number of employees: 10-49	4.6	5.4
Number of employees: 50-249	10.4	11.6
Number of employees: 250 and more	27.0	24.2

Source: [17, p. 4].

In the years 2014-2016, compared to the period 2011-2013, an increase of 1.4% in product innovations in industrial and service enterprises was recorded - 0.6%. There is no doubt that a greater development of product innovations in Polish enterprises requires further and even more dynamic spending on R&D [38]. It should be emphasized that large companies, both industrial and service ones, due to greater possibilities of financing R&D showed greater innovative activity compared to small ones. The share in the group of large industrial enterprises that introduced product innovations in 2011-2013 was 42.7%, and small 6.1%, and in 2014-2016 respectively 44.2% and 7.1%. In the case of service companies, these differences were smaller and amounted to 27.0% and 4.6% in 2011-2013, and 24.2 and 5.4% in 2014-2016.

Chart 2 shows the % share of companies that introduced product innovations in 2011-2013 and 2014-2016.

Chart 2. Product innovations in industrial and service enterprises.

Source: own study based on: [7].

4. How to Overcome the Financial Barrier to Ensure the Right Development of Product Innovation for Companies?

Expenditures on innovative activity in Poland amount to 0.94% of GDP with the OECD average – 2.4% of GDP [19]. Such low expenditures on innovative activity are mainly the result of difficulties encountered by our companies in mobilizing more funds for this purpose. These are mainly own funds of enterprises (over 70%), and a much smaller share are bank loans (only about 6.7%) and funds obtained from abroad (about 2%). In such a situation, financial barriers will in most cases arise for companies that are interested in introducing product innovations. Therefore, the company's finances should be managed in such a way as to make greater use of available external funds to solve these problems. Companies should make greater use of external financial resources (not only in the form of loans). Moreover, in their innovation strategies, managers should always refer to the life-cycle phases of existing products, as this has a significant impact on profit development. It is important at what point in time a company launches a new product on the market. If this process is delayed and the existing products are in a declining market, the company may have financial difficulties in a relatively short period of time. Once the sales growth rate has slowed down, the company should be prepared to launch a new product on the market. Systematic renewal of production is therefore essential for the development of profit and long-term economic equilibrium of the company. Stopping the process of renewing the production program also leads to an increase in the spread between the desired amount of profit and the decreasing amount of profit that can be achieved when selling existing products. In maintaining a long-term economic and financial balance in the company, it is also important whether it optimally uses the various forms of foreign capital available, including aid funds. The idea is for enterprises to use not only bank loans but, to a greater extent, such forms of financing as: leasing, franchise, loans from loan funds, loan securities in the capital market or in the form of shares (New connect market, venture capital funds, business angels).

Comprehensive state aid is very important in reducing the financial barrier for small and medium enterprises in the development of product innovations. Such companies can benefit from it within the framework of the common European policy under the conditions set out in the Europe Agreement. Multiannual support programmes implemented by the EU are an element of the long-term development strategy.

Enterprises may receive support also through the Polish Agency for Enterprise Development. That help can be in the form of subsidies for co-financing of training, consulting, information and investment services. Companies may also benefit from the assistance of local governments, state administration bodies, administrative bodies and non-governmental organisations.

It should be emphasised that in Poland the support in the form of state aid for enterprises is insufficient. It is presented differently in particular groups of the SME sector. Research conducted by the Polish Economic Institute in March 2019 indicates that 62% of large enterprises, 50% of medium enterprises, 31% of small enterprises and only 22% of microenterprises use state aid [29]. The most frequently indicated forms of assistance were: grants, tax exemptions and loans or preferential loans.

5. Summary

The product innovation development in Polish enterprises is connected to the scale of expenditure on R&D. It should be emphasized that large companies, both industrial and service ones, due to greater possibilities at financing from their own resources (they dominate), manifested greater innovative activity in comparison with small ones. Therefore, wider access of enterprises to various sources of financing innovation can be an important factor in improving the situation of small and medium enterprises in this area.

In the group of large industrial enterprises, the share of those who introduced product innovations in the years 2011-2013 was 42.7%, and in the group of small enterprises - 6.1%, and in the years 2014-2016 respectively 44.2% and 7.1%.

In the examined period there was an increase in the dynamics of internal outlays of enterprises on R&D activity and there was a significant improvement in the percentage of the relation to GDP from 0.72 to approx. 1. However, these outlays of enterprises are still insufficient, although their average annual growth rate in 2010-2017 was 26.8%.[7]

It is also important that companies not only use internal sources of innovation, but demonstrate greater activity in searching for external sources. Meanwhile, between 2010 and 2016, very unfavourable indicators were recorded in relation to purchases of: licences (-27 and -32%), R&D (-9% and -28%) and automation measures (-28% and 39%).

Therefore, these forms of activity require greater integration inside and outside the company. We must always remember that preparation of an innovative strategy requires a number of research and cognitive activities aimed at determining such parameters as market absorption, demand for a given product, cost estimate and risk assessment. Mentioned strategy should be market-oriented, so it ought to focus on customer needs and demand as the forces stimulating these innovations. Numerous research studies provide strong arguments indicating that the active participation of customers in the development of an innovation strategy allows for the implementation of better new products (new product development) [10]. This also involves the proper use of entities such as technology and rationalisation clubs as well as technology agencies, which provide legal, technical and organisational assistance to inventors and rationalisers. Entrepreneurship incubators also provide production space and technical and office services to start-up companies.

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Notes

1. For the purpose of this paper, large companies have also been included in the study in order to extend the comparative base.
2. Christoph Fuchs from Rotterdam School of Management, Erasmus University and Martin Schreier from Bocconi University presented the results of their research on this subject in the article "Customer empowerment in new product development" in *the Journal of Product Innovation Management* [10].
3. The development of innovation with the use of European funds is based on several key pillars, including first of all: supporting the establishment of research and development centres and investments of entrepreneurs in innovative solutions and modern technologies; expanding the research base of scientific entities and improving qualifications of scientific staff as well as creating business environment institutions [17].
4. The number of business environment centres in Poland has been growing dynamically since 1990. Currently there are 54 Technology Parks, 69 Technology Transfer Centres and 182 Technology Clusters and Cluster Initiatives in Poland.

5. In fact, this indicator may be slightly higher as many companies tend to include R&D expenditure in their profit and loss account and do not report it separately [26, pp. 8-12].
6. Much higher indicators were already achieved in 2010 by countries such as South Korea - 3.74% of GDP, the USA - 2.88% of GDP, Germany - 2.82% of GDP, Finland - 3.87% of GDP, Great Britain - 1.77% of GDP. The KPMG survey shows that 57 percent of medium and large companies operating in Poland conduct or commission research and development (R&D).
7. Outlays on R&D in Poland are steadily increasing and it is assumed that they will constitute 1.7% of GDP in 2020. The large increase in R&D expenditure assumed for 2020 still leaves our country in a distant position in relation not only to the leaders, but also to those countries with average expenditure.

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Financialization of Commodity Market

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Abstract:
The aim of the article is to present possible consequences caused by the development of commodity market financialization understood by the influence of financial investor's speculation. Also the task of elaboration is to outline the existence of financial factors in the price creation process of commodities. The existing impact of financialization on the volatility of commodity prices significantly modifies the market. The results of the research and analyzes carried out indicate a similarity in the behavior of the markets of commodities. The situation results from the redistribution of the risk of financial investors who having a few goods in the investment portfolio, next to large transaction volumes affect the unification of price trends. Price shaping factors are being transformed. The decrease importance of supply or consumption in the context of the commodities market changes its form. The growing influence of investors who create numerous speculations transforms the market. Trade in *futures* contracts affects the level of commodities prices.
Keywords: commodities, financialization, investment, speculations.

1. Introduction

Financialization is a pioneering and new process that has recently begun to shape new rules in economics. The process consists of increasing the importance of the financial sector in the economy. The transformation of various assets into investment instruments permeates their structure of primary destination [2]. The commodities cease to fulfill the role of satisfying hunger or generating energy, but there are also assets similar to stock exchange companies that can be sold and bought. The study focuses on factors influencing the price of commodities. The analyzed commodities are gold, silver, copper, crude oil and natural gas. These commodities have the largest volumes on the world *futures* market. The research period is the data from 2000-2018 on a monthly basis. Data on the tested goods come from the Thomson Reuters database. The survey methodology includes elements of descriptive statistics, a comparison of changes in the price level of the assets with unexplored indexes, measures of the dynamics of phenomena and Pearson's linear correlation study. The research hypothesis is the impact of concluding *futures* contracts on the price of commodities. The verification of the influence of investors on the *futures* exchange market in price formation is the main goal of the article. The increase volume of trade in commodities on electronic

exchange market fundamentally modifies the structure of the market, making the analyzed assets into speculative financial instruments.

2. Financialization

Financialization began at the end of the twentieth century in the United States. Mark the increase in the importance of the financial sector in the economy. It is also understood as the overgrowth the size of the financial market over the production sector. The process began to penetrate more and more spheres of the economy. Now, many assets are traded on global exchange [6]. The emergence of innovative financial instruments has absorbed assets from various markets. *Futures, forward, swaps or options* contracts include the trade of goods such as metals and food products. The combination of assets from different areas makes the financial sector even more extensive and liquid [4]. Condensation of many types of assets in one place, i.e. shares, bonds and commodities may lead to their harmonization in terms of demand and supply. Unification may rely on similar price trends of various groups of assets, decreasing the role of real economy factors such as production, exports, imports, harvest size, weather conditions and market trends. The volume of *futures* contracts, meaning the supply and demand of e-commerce on international exchanges, gains in importance [11]. The reason for the radical progress of financialization in the economy is the significant development of capitalism that can be observed from the 1960s. The increase of the efficiency ethos is transformed by the hitherto concept of entrepreneurship. Effectiveness understood in the sense of financialization consists in an attempt to maximize economic activities at the technical and economic level of subordinated financial efficiency [7]. The major change in the investment and speculation in the sense of effectiveness is the amount of planned revenues. Until some time, investors planned the income they would like to get. Currently, financialization outlines an unlimited profit that never ends. The avidity of profit maximization is able to distort the markets, including the commodities sector [15]. Trade in the commodities without production, extraction or later consumption and use shows the unrealisation of the economy which only starts to take on commodities character.

The analyzed process leads to an increase in transactions of a financial nature. The unceasing repetition of purchase and sale of the same asset by a single entity shows the stock exchange nature of commodities trading. Investors are not interested in using the traded goods but in making the difference resulting from the spread. The activity of speculators blurs the boundary between trade, investment and consumption [3]. This leads to a conflict between the financial, industrial and labor market. Deregulation of financial markets and the increasing liberalization of cash flows are factors that intensify the process of financing. The development of modern IT solutions is also an important aspect of the development and expansion of financial market activities [13]. Lack of legal regulations regarding trading in shares or commodities encourages more entities to deal with many markets of the plane of unlimited speculation. With the described process, commodities become an investment asset that is not characterized by its physical utility. Structural changes indicate the feat of the process. The likeness of commodities with stocks or bonds affects the side of their demand and supply [16].

Financialization can also be understood as an increase in the allocation of monetary resources to the financial sector than in the production, industry or services sector [14]. Economic development has so far consisted of three stages. At the beginning of economic development, agriculture was important. As the countries got rich, there was a shift to the industrial sector. The last stage of development were services. Financialization from the end of the twentieth century creates a different dimension of the concept of development and transformations of the economy [1]. This increase in the number of financial instruments, the volume of transactions or open positions on the stock market is to determine the economic level. The size of conglomerates measured by the assets it owns is also a determinant that leads the perception of the national economy. The problem is that in the event of a financial crisis, the interconnected markets – stock

markets, currencies, bonds or stocks measured in currencies may turn out to be worthless assets in an instant. Too much merger of economies with a financial crisis poses a lot of danger in the event of an economic crisis [15]. The occurrence of a domino effect in such a situation may lead to a tragic financial situation and a drop in the value of many assets, not only financial ones.

Financialization of the commodity market involves the influence of virtual exchange factors on the valuation of these goods. *Futures* transactions on the market currently have the largest impact. Their enormous scale leads to the creation of commodity prices and a decrease in real economy factors such as demand and supply.

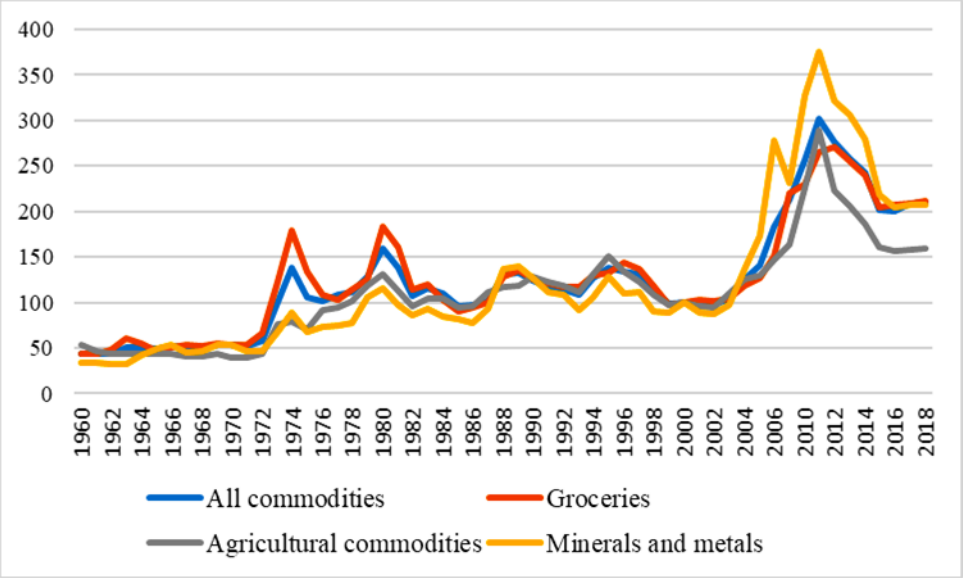
3. Commodity Market

Since the beginning of the global economy, the commodity market has been an extremely important element in economic development. Assets, such as gold or silver have already had a lot of functions in the antiquity like a measure of value, a means of payment, a thesaurisation or a medium of exchange. As the historical graphs of gold, platinum or silver prices show, these assets have always been a protection against inflation. Precious metals have a more stable value than a lot of international currencies. However, this state of affairs is transformed and modified. A long-term risk premium or nature similar to the stock market means that the commodities become the investor's demand for assets [19].

In the last 40 years, the commodity market has significantly changed. The market modification depends to a large extent on the financing process. The growing role of financial investors means that real supply and demand for commodities is not important in shaping prices. Another significant direction of changes in the process of the impact of the financing process on the commodities market is the increase in the number of listed assets. With each passing year, there are more goods that can become the instigator of trading in commodities [12].

The enormous inflow of capital to the sector modifies it into a capitalist creation similar to the enterprise stock market. Redistribution of risk by investing in various types of assets leads to a similar trend of prices [17]. Large-scale investment in commodity aimed at reducing the risk of investment in finances leads to analogous and very similar shaping of the markets of particular commodity groups. An example of activity over the years allow to present this fact. Chart 1 illustrates the historical price formation of various commodity groups over the years, from early 1960 to 2018. The period includes monthly data.

Figure 1. Forming prices of agricultural products, groceries, minerals and metals and whole group over the years 1960-2018.



Source: Own work based on www.unctadstat.unctad.org [18].

The presented chart shows significant dependence between the studied groups of goods. Powerful and similar tendencies can be observed from the beginning of the 1960s. The period of the economic crisis of 2008-2011 led to slight delamination between individual groups of assets. However, after the economic turmoil is over, there is a return to the pre-crisis tendency, i.e. characterized by similar price movements. There is also a growing relationship between the analyzed commodities and the stock market. Common tendencies between the two separate markets are beginning to take on similar trends [9]. The high connection between commodities it does not result from substitution or complementarity but be connected with transactions on the *futures* contracts exchange.

To fairly present the level of dependencies between commodities, it is worth focusing on commodities whose turnover on the *futures* market was the highest (gold, silver, copper, WTI crude oil and natural gas). Statistics were showed in table 1.

Table 1. The number of futures contracts concluded in 2018 on the world commodity market.

COMMODITIES	FUTURES CONTRACTS
WTI crude oil	147 950 000
Natural gas	39 360 000
Gold	425 320
Copper	223 660
Silver	165 430

Source: Own work based on Thomson Reuters database.

The study of the correlation coefficient will cover the years 2000-2018 when the financialization process has developed most. The analyzed period is based on monthly data. The collinearity level will be presented on the substitution of Pearson's linear correlation study. It is showed in table 2.

The significance of the linear correlation coefficients was verified by the U test.

$$U = \frac{\rho}{1-\rho^2} - \sqrt{T}$$

U ~ N(0,1), critical value ± 1,96, significance level α = 0,05

T – number of observations (216), ρ – correlation coefficient

Table 2. Correlation coefficient between the prices of analyzed commodities in the years 2000-2018.

	Gold	**Oil**	**Copper**	**Gas**	**Silver**
Gold	1				
Oil	0,823* [-12,145]	1			
Copper	0,815* [-12,269]	0,893* [-10,288]	1		
Natural gas	0,382* [-14,245]	0,112* [-14,586]	0,023* [-14,673]	1	
Silver	0,947* [-5,519]	0,831* [-12,011]	0,844* [-11,763]	-0,252* [-14,966]	1

Source: Own work based on Thomson Reuters database.

* Values are statistically significant at level α = 0,05, in square brackets are critical values.

The high correlation between silver and gold is not astonishment, but the high level of correlation among other types of assets is curious. The correlation tested is the highest when the results are close to 1. In the case of values close to 0, there is no relationship between the assets. Negative

values represent the occurrence of inversely proportional forces. The level of collinearity in the analyzed period of time between oil and gold is above 0,8, which indicates a strong assimilation of markets. A similar situation occurs in the case of steam with oil and silver. A high correlation can be observed in the case of a pair of silver and copper, where the coefficient of dependence is 0,84. There is no dependence in the case of gas and copper, where the correlation coefficient is close to zero. The opposite relationship is low in the case of silver and gas, where the correlation value is negative what shows opposite tendencies.

The presented table shows dealing with similar trends in shaping the prices of many commodities assets. There are commodities that do not show similar relations but the example of copper and oil shows that assets that are not substitute or complementary products exhibit similar behavior on the market. The growing volumes of transactions make the individual commodity markets similar [16]. The high correlation between these goods is also partly due to the fact that financial investors value them based on certain forecasts of future economic growth in the global market. The information obtained about economic activity has an impact on the process of increasing the prices of both commodities. The price creation process is intricate and full of various dependencies. Progressive financialization penetrates the process of volatility of commodities on the market. This situation may have a cause in the manifested growth of speculators on the commodity. The progressing financialization of the commodity market will transform the market into a trading platform similar to the stock market, where the profit resulting from the difference in purchase and sales is significant, not the functionality of commodities as it was some time ago.

The decrease in the significance of commodity producers in the context of price formation shows the nature of analyzed process. The dependence of setting prices on *futures* market is currently one of the major price determinants [10]. The factor that is responsible for the dependence of commodities on each other is also predictability. An attempt to predict or forecast prices based on the behavior of the *forward* market indicates innovative changes in the factors affecting commodities prices [5].

Process describes the financial market's impact on the economy. One of the key markets of the financial sector is the currency market. The influence of the level of international currency quotation is a key factor in the prices of a few assets. Analyzing the process of financialization the commodity market, it is extremely significant to trace the level of correlation between commodities prices and the currency in which these assets are listed on the market exchange. All assets covered by the survey are expressed in USD, which is why this currency will be a collinearity meter. Described sets have been presented in the table number 3.

Table 3. The level of correlation between the US dollar and the prices of the analyzed commodities in the years 2000-2018.

Commodities	**The level of correlation with the US dollar**
Gold	0,483* [-14,045]
Silver	0,564* [-13,855]
Copper	0,751* [-12,987]
Oil WTI	0,753* [-12,961]
Gas oil	0,342* [-14,306]

Source: Own work based on Thomson Reuters database.
* Values are statistically significant at level $\alpha = 0,05$, in square brackets are critical values.

The level of correlation has been verified for the analyzed commodities over 18 years from the beginning of the 20th century. A level of correlation close to 1 indicates a very strong correlation, while results close to zero indicate that there is no convergence between the analyzed structures. The highest level of correlation was recorded for copper and crude oil. Interestingly, the level of correlation between the dollar and these commodities is almost identical and amounts to 0,75. The

result indicates a strong dependence of copper and oil on the US dollar. The level of silver correlation is also high and amounts to 0,57 and the level of gold and USD dollar dependence was slightly less, i.e. 0,5. The lowest level of linear correlation was for the ratio of natural gas which was 0,34. Such value does not indicate a mutual relationship between the analyzed assets and the dollar. The situation may have a cause in the political determinants of Russia's operations, which is the main producer of natural gas in the world. In this case, the quotation of the dollar currency is not a strong factor in creating prices of the analyzed assets. In other markets surveyed, the USD currency is an important factor in the price formation process. The presented analysis of the Pearson's linear correlation showed that the currency market is becoming a statistically significant factor for shaping the prices of the majority of commodities. The penetration of the financial area into the sector of markets, including commodities, gives direction and shape to areas of the global economy.

The listing of commodities in the currency of dollars is one of the major examples of the financial market's impact. Not only the valuation of commodities is a coherent element combining this market with foreign exchange. The cause-and-effect nature is also an important determinant of price formation [8].

4. Result and Discussion

The financialization process leads to the situation when *futures* exchanges affects the current price of commodities. The prices of diversified assets can be identified. The impact of the USD dollar exchange rate is also significant for most of them. The examined process determines the market of commodities. An open issue is the impact on other, also key products of the world economy. The financialization process also significantly contributes to the increase in market volatility and the increasing dependence of individual commodity groups on each other.

Since the beginning of this century, a significant interdependence of prices on the commodity market can be observed. The likelihood of variability fluctuations on the *spot* and *futures* markets shows synergy and market relation [5]. The strong influence of the market of time-bound anchors transforms the previously occurring cycles related to changes in supply or consumption.

The financial dimension of transactions on the *futures* market shows the separation of commodities from reality. The lack of a physical commodities supply requirement for large number of *futures* transactions indicates the use of goods as financial assets [8]. The difference between the purchase and sale of assets is a determinant of trade. The decrease in the importance of the use of commodities shows the merging of the border between use and virtual trade.

The impact of *spot* prices on *futures* was the only sphere of influence of individual markets. Currently, the possibility of a relation between the *forward* contracts market understood as the volume of transactions or the number of open positions is also a factor that is a feedback stimulus for creating the price of assets. Such strong changes affect the existing important price factors such as consumption or production [10].

New financial instruments bring new possibilities of trading in various assets by transforming the financial market. The creation of *options*, *swaps* and *futures* makes the commodity market a bookmaker's activity. Current situation on the market minimalizes the role of commodities in their usefulness. Not using resources to create energy, satisfy hunger, use in jewellery or medicine spoils their usefulness. It brings commodities to investment assets whose use loses value and meaning. Only the sale and purchase price counts. Constant changes make the commodity market and other areas a platform for speculation on which the largest individuals earn, while consumers and producers lose their capital and time [2]. Trade in commodities is an end in itself. The use of the discussed assets in terms of consumption or production is a foreign process as

part of financialization. Speculations on the *futures* market show that commodities are becoming the subject of financial market.

5. Summary

The goal of the study was to present the impact of financial investor's behavior on the level of prices of selected commodities listed on stock exchanges. Progressive financialization transforms existing financial market structures. The analyzed process significantly influences the volatility of commodity prices. The market is full of speculators who are not interested in acquiring physical assets. Huge transactions of various types of commodity subjects lead to similar price movements. The similarity of commodity market to financial assets may threaten the flow of all economic turmoil and crises. The penetration of the financial's market determinants, including the currency one, gives character and direction to the movements of the prices of many commodities. There are exceptions to this practice when there is a visible impact of the political activities of countries that are a large world exporter, as is the case on the natural gas market.

Research methodology examined by the Pearson product-moment correlation coefficient and elements of descriptive statistics have proved a large dependence between each other's commodities. The results of tests and assumptions indicate that there is a high impact of speculators and changes in the *futures* market in the creation of commodity prices. The effect of the *future* market on *spot* prices can be seen in the case of gold, silver, copper or oil. The impact of financial investors actions reduces the significance of real economy factors such as production or consumption, which until now were the foundation of price changes.

The uniqueness of the ongoing process lies in the fact that financialization is a completely new creation of the real economy. Until the end of the twentieth century, there was no significant impact of the financial market on the economy. At present, the process is transforming a few structures, including the commodities market. The presented study indicates that merging many markets with the financial sector results in significant relationships between assets. The high dependence of industrial goods or commodities can lead to dangerous situations. In the event of a financial crisis, the capital market may also plunge the commodities market. The domino effect in the situation of large dependencies of commodities between each other and the stock market may be a consequence of a decrease in their value at the moment of market disturbances. Structural changes in the commodity market are causing their real utility. The economic situation is not without significance for the level of dependence of commodity prices. Expansion and recovery favor the growth of links between the analyzed goods.

The development of financialization not only damages the commodity sector, but also itself. This process can lead to the destruction of money. The possibility of a decrease in the function of thesaurisation, the means of payment or the value measure may lead to disturbances on the global market. A strong connection with other assets creates a threat to the economic stability of the whole world. There is a relationship between the development of financialization and the level of changes in the prices of the researched commodities. The decline in the importance of real economy factors in shaping commodity prices is a detachment from the classical economy and its transformation into financial determinants only. The lack of restrictions in trading on the commodity market may have a negative impact on the stability and liquidity of the global economy. Manufacturers and consumers are at risk. Commodities have become the subject of colossal speculation, the consequences of which may affect the entire economy.

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The Role of the Bank in Meeting the Housing Needs of an Average Household – Evaluation of the Situation in 2018

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Abstract:
The aim of the article is to determine the profile of an average Polish household and the possibility of satisfying average housing needs thereof as well as to indicate the role played by the bank in their implementation. The characteristics of an average household, the value of income and expenses thereof, the prices of residential properties and the data of the credit market were determined. The research material was obtained from reports and statistical studies, including data from the Statistics Poland, Eurostat, the database of residential property prices of the National Bank of Poland and the average offer prices of the rental market – for 2018, which reflects the current economic situation. The research was of a quantitative nature (statistical measures, housing availability index, credit simulations). The results indicate that as of 2018 an average household cannot afford to buy or rent a flat. The bank's role in satisfying housing needs is not only important but rather necessary.
Keywords: residential needs, residential property, housing market, mortgage loan.

1. Introduction

There shall be no doubt that having a place to live with a sense of security and privacy is a fundamental need in everyone's life. Moreover, it is pointed out that adequate satisfaction of these needs is related to affordable housing price and secure environment [19]. Studies show that it is a priority to meet one's and one's family's security needs when it comes to spending savings [5]. The fulfilment of housing needs also depends on whether households will be able to satisfy higher needs. Taiwo et al. [32] indicate that the choice of a housing property is determined by factors such as fixed income, the relationship between ownership costs and rental costs as well as the current phase of the household life cycle. Apart from income, Augustyniak et al. [1] also emphasize the importance of interest rates and prices (in the context of purchase of real estate on the primary market) and indicate the significant role of a real estate market analysis.

Numerous countries face the problem of satisfying housing needs, e.g. in Australia the inability to satisfy thereof is a serious problem and identified with the "housing stress"[1] concept

[35]. According to Eurostat data [19], Poland is characterised by a high percentage of young adults living with their parents (in 2018 – 45.1% of people at age of 25-34) and one of the highest overpopulation rates among the population at risk of poverty (49.8% – 2017). At the same time, there is a strong desire to meet the housing needs by purchasing real estate. The percentage of owned properties in Poland is one of the highest in Europe (84% including 11.3% constituting mortgaged properties). The remaining 14% are housing properties which are rented [18].

The issues related to the satisfaction of housing needs are frequently discussed in the literature. Most of the research in this area concerns, among others, decision-making conditions [3], [22], housing preferences [30] and their modelling [2], [33], [34]. However, there are no items discussing the actual financial capacity of households to meet their housing needs and the analysis of the actual market conditions in which decisions concerning their implementation are made.

High housing prices and relatively low household incomes limit the ability to meet housing needs effectively. This problem is illustrated by the housing availability index, which expresses the residential real estate area that can be purchased for the average monthly wage in the enterprise sector. The research conducted for the years 2006-2018 on the primary and secondary market for Warsaw and the next 5 largest cities in Poland shows that the housing availability on both these markets shows a growing tendency, however, the values of this indicator are still too low to meet the housing needs of average households [25]. The literature indicates that the degree of satisfaction of housing needs depends significantly on the possibility of obtaining a housing loan [23]. The bank's role in this process is therefore obvious but the above studies do not indicate the extent thereof.

The aim of the paper is to indicate the bank's role in meeting the housing needs of households by defining the profile of an average Polish household and the possibility of satisfying average housing needs thereof.

This article attempts to answer the following questions: What is the current situation on the residential real estate market in terms of transaction prices and rental prices? What is the financial situation of an average household aiming at satisfying housing needs? Is an average household able to satisfy its housing needs without external financing? Consequently, how important is the bank in meeting these needs?

In order to achieve this goal, a research hypothesis was formulated as follows: According to the conditions in 2018, an average household cannot afford to meet the average housing needs, particularly with regard to the purchase of real estate. An auxiliary hypothesis was also formulated: An average household can meet its average housing needs only by financing the purchase of real estate with a mortgage loan.

2. Material and Method

In order to achieve the previously assumed research goal and to verify the hypothesis, the research was divided into 4 stages. In the first one, the average household was characterized in terms of the number of persons, disposable income and expenses. The determination of these values made it possible to calculate the financial surplus which is at households' disposal on a monthly basis. It has been assumed that it can be used to meet housing needs. The material for analysis was obtained from the Statistics Poland (GUS) [31] data and own calculations.

Then, the average housing needs of households were defined by determining the average housing area occupied by households as well as the average number of rooms occupied by residential properties (stage 2). Also in this case, the data was taken from the Statistics Poland [31].

In the third stage of the research, the market conditions in which households decided to satisfy their housing needs were defined. For this purpose, average transaction prices of residential properties were established having taken into account primary and secondary market as well as average rental prices were established. It shall be noted here that in Poland there is a high asymmetry of information concerning the development of transaction prices and rental prices of residential properties. There is no obligation to record these transactions in a public database, that is

why market transparency in this respect and a realistic assessment of the market is hampered, particularly in terms of rental prices. Therefore, to assess the situation in the above mentioned scope, appropriately averaged data from the National Bank of Poland (NBP) residential property prices database [4] and from the reports of the Internet portal Bankier.pl [6 to 17] on prices of residential property rental offers were used. Then, based on the obtained average values, the value of the average flat on the primary and secondary market was calculated. The housing availability index (HAI) [24][2] was also calculated modifying it for the purposes of this publication as follows:

$$\text{Modified housing availability index (MHAI)} = \frac{\text{average monthly surplus per average household}}{\text{average transaction price on primary or secondary market}}$$

The value of the housing availability index after modification determines how many square meters of usable floor space of a residential property can be purchased for the average monthly financial surplus per average household. The higher the value of the indicator, the greater the availability of housing and vice versa.

The last stage of the survey assumes the determination of the average household's ability to finance the purchase of a property with a mortgage loan. For this purpose, the average mortgage loan margin and the average WIBOR 3M were first determined. The margin value was determined as an average according to data taken from AMRON-SARFiN reports, provided that the value of the mortgage loan granted amounted to PLN 300,000 at the 75% LtV level, for a 25-year period [26], [27], [28], [29]. The average WIBOR 3M was calculated on the basis of data excerpted from the Stooq.pl website [21]. Then, based on the existing results a credit simulation was performed, according to which an average monthly loan instalment was determined on the grounds of the formula for an equal total instalment loan (this type of loans is predominant in Poland).

It is possible to obtain two pieces of information with a determined value of an average credit instalment for an average household aiming at satisfying average housing needs, having taken into account predetermined average transaction prices on the primary and secondary markets. First of all, whether the average household with the available surplus is creditworthy and will be able to repay the monthly instalments of the loan.

In order to provide comparison, all data included herein were determined for the year 2018 in order to reflect the real financial situation of households and their ability to finance real estate purchases with mortgage credit. The exception is the modified housing availability index, which was additionally calculated both for 2018 and for the last 5 years in order to establish a trend (rising or falling).

3. Results and Discussion

In order to provide clarity, Table 1 presents the results of particular stages of the study according to the division adopted in the methodological part.

When analysing the results obtained, it can be assumed that in most cases the average household consists of 3 persons. Having taken into account the reliability of the survey and simultaneously being aware that in the economic reality there is no household consisting of 2.64 persons, the calculations were based on the indicated value according to the statistical data provided by the Statistics Poland. The results presented will therefore reflect the most realistic economic situation.

Table 1. Average household, average housing needs, market conditions, credit conditions - own research results.

Specification	Value
1. Average household	
Number of persons	2.64

Available income / 1 person	PLN 1,693.46
Total expenditure / 1 person	PLN 1,186.86
Financial surplus	PLN 1,337.42
2. Average housing needs	
Average surface area of the apartment per average household	79.4 m^2
Number of rooms	3 rooms
3. Market conditions	
Average transaction prices - primary market	PLN 5,905/m^2
Value of average apartment - primary market	PLN 468,857
Average transaction prices - secondary market	PLN 5,447/m^2
Value of average apartment - secondary market	PLN 432,491.8
Modified housing availability index - primary market	0.23 m^2 (rising trend)
Modified housing availability index - secondary market	0.25 m^2 (rising trend)
Average rental prices	PLN 2,323.56
4. Loan conditions	
Average margin	2.04 %
Average WIBOR 3M	1.711 %

Source: Own materials.

Knowing the value of disposable income and total expenses per person, the amount remaining at the disposal of an average household was calculated as a financial surplus which amounts to PLN 1,337.42 per month. The key point of the stage of this research was to check what the total expenditure includes and consequently what the financial surplus may be allocated for. The Statistics Poland [36] indicates that total expenditures include only the costs of using a flat or house together with energy carriers and equipment thereof. It was therefore assumed that the funds related to the satisfaction of housing needs, i.e. those needed for the rental or purchase of a housing property, should come from financial surplus or savings.

Determining the housing needs of an average household is very difficult. First of all, it should be assumed that the average household is the one whose existing housing situation is already satisfied, however, for some reasons these households strive to satisfy thereof in a different (or better) way. It is closely related to the life cycle phase or other conditions such as e.g. moving away from parents, labour migration, a larger usable area needed, striving for ownership. Therefore, it was assumed that average households will endeavour to satisfy their housing needs at the level of minimum average values in terms of usable area and number of rooms for the year under review. According to statistical data, in 2018 an average household occupied a flat with an area of 79.4 m^2 consisting of 3 rooms. On average, there were 28.4 m^2 of usable floor space and 1 room per person in the household [31]. Secondly, it should be pointed out that the housing needs are individualised and it is impossible to determine them in real terms on the national level. It was also considered to include data concerning the average usable area of flats brought into use in 2018. It was calculated that this area is even higher and amounts to 90.29 m^2.

Having only information on average residential property prices in Poland on the primary and secondary markets, it was assumed that each of them meets the requirement of 3 rooms minimum. It was calculated that a flat meeting the needs of an average household will cost PLN 468,857 on the primary market and PLN 432,491.80 on the secondary market. The value of a flat on the primary

market is about 8% higher than on the secondary market. A modified housing availability index was also calculated for individual markets which is 0.23 m^2 for the primary market and 0.25 m^2 for the secondary market. This means that if we assume that an average household allocates the entire monthly financial surplus, it can afford to buy 0.23 m^2 and 0.25 m^2 of a flat usable floor space respectively. To better illustrate the importance of the results obtained, it was calculated the period in years within which an average household can purchase a property on the primary (about 29 years) or secondary (about 27 years) market, provided that the equivalent of the entire monthly financial surplus is allocated for this purpose. Additional calculations show that the indicator has been increasing in the last 5 years. On each of the markets there was an annual increase in the index value by an average of 0.02 m^2 per year (in total by 0.1 m^2 of usable area). The growth rate of the housing availability index and other values prove that in order to meet the housing needs of an average household, it is necessary to use external sources of financing, e.g. a mortgage loan.

Due to the lack of the data concerning the actual rental prices on the residential property market, it was necessary to adopt the average offer price which during the period considered amounted to PLN 2 323,56. In this respect, it should be pointed out that the offer prices are higher than the market rental prices, however, the difference obtained is too big. The average offer rental price exceeds the financial surplus of an average household almost twice which leads to the conclusion that this way of satisfying the housing needs from own funds is not available thereto.

Taking into account the above results concerning the possibility of financing the purchase or renting real estate, it is obvious that an average household has to use external sources of financing. The main hypothesis has therefore been verified positively. While in the case of purchasing a property, one of the options is to use a mortgage loan, in so far in case of renting a flat taking out a loan is not only impossible but most of all irrational. The property purchased increases the household's assets and can be sold or rented out, if needed.

In view of the above results, it is still necessary to check whether the average household can afford to buy a flat with the use of a mortgage loan. In order to make a decision, it was necessary to determine the average credit instalment and carry out a credit simulation. To determine the average credit instalment in 2018, the average 2.04% margin and the average WIBOR 3M = 1.711% were taken. Assuming that an average household would have funds for the owner’s contribution (25% of the loan value) and would obtain a loan for 25 years at a fixed interest rate, the average credit instalment for an average residential property on the primary market would amount to PLN 1,800, whereas on the secondary market to PLN 1,1677.77 (Table 2).

Table 2. Loan simulation.

Market	Value of the apartment (PLN)	Wibor 3M (%)	Average margin (%)	Interest rate (%)	Capital (in PLN)	Number of instalments in total	Value of monthly instalment (PLN)	Loan cost in total (PLN)*
Primary	468,857	1.711	2.04	3.751	351642.75	300	1808.00	542401.15
Secondary	432,491.8	1.711	2.04	3.751	324368.85	300	1667.77	500331.76

*The total cost of the loan shall not include additional costs, i.e. bank commission, insurance, etc.
Source: Own materials.

When comparing the value of the loan average monthly instalment with the value of an average apartment on the primary and secondary market, the results clearly indicate that an average

household cannot satisfy the average housing needs by purchasing a property with a mortgage loan. The auxiliary hypothesis should therefore be rejected.
Therefore, it was verified which usable area of a residential real estate an average household could afford to satisfy housing needs thereof with a mortgage loan. The results are presented in Table 3 below divided into primary and secondary market for the same assumptions as those adopted in the credit simulation presented in Table 2.

Table 3. Average value of a mortgage loan instalment with a lower usable floor area.

Market	Average instalment for area of 35 m^2 (PLN)	Average instalment for area of 50 m^2 (PLN)	Average instalment for area of 60 m^2 (PLN)
Primary	796.92	1138.54	1366.25
Secondary	735.16	1050.23	1260.38

Source: Own materials.

In view of the assumptions adopted previously, an average household could satisfy lower housing needs, i.e. for both primary and secondary markets and up to an area of approximately 60 m^2. In the case of the primary market, the average instalment slightly exceeds the financial surplus.

4. Conclusions

In accordance with the presented results, the situation of an average household aiming at satisfying average housing needs in the real estate market should be described as critical. Household income is not rising as fast as property market prices which causes quantifiable difficulties. The financial surplus, which remains every month after the necessary expenses have been paid, is not sufficient for the rental or purchase of a real estate, both on the primary and secondary markets, even if it is allocated for this purpose in 100%. Moreover, assuming that the household has savings on equity, this amount shall not be sufficient to repay the average monthly instalment of the loan.

Nowadays the growing role of banks in household life is indisputable but a study has shown how important it really is to have mortgage loans granted by banks. An average household is not able to satisfy its average housing needs because the financial surplus at its disposal is too low and it cannot even repay the loan. Without external financing, the average household will not be able to meet its average housing needs. Moreover, there is currently no product on the financial market that could effectively replace a mortgage loan. Thus, with the current financial conditions of households and the situation on the housing market, a household which wants to satisfy its housing needs is forced to take out a mortgage. The bank, and more precisely the loan it grants, is the only chance for the average household to meet its housing needs. Its role is therefore significant.

The assumptions applied in the study were extreme, i.e. the assumption that the entire financial surplus would be used to satisfy average housing needs or that the average housing area would be relatively high in the author's opinion. Many households, particularly those purchasing the first property, choose a smaller area, therefore other scenarios may be considered.

The only possibility seems to be the satisfaction of the housing needs of an average household to a lower degree than originally assumed, i.e. with a residential property not exceeding the usable area of 60 m^2. However, it will be possible to meet these needs, only provided that mortgage loan financing is granted.

It should also be pointed out that the financial situation of households and the housing market is different in many regions. Different transaction prices and income are achieved in Warsaw, others in smaller towns. In order to fully show the differences between the regions, it is necessary to take into account, in particular, the specificity of each local real estate market, along with the situation on the labour market. The survey shows averaged values for the whole of Poland both in terms of data on the housing market and the assets of an average household.

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Notes

1. The term "housing stress" is defined by the 30/40 rule which means that housing costs amount to at least 30% of income and are concentrated in 40% of households with the lowest income, adjusted and characterised by the size of the household. According to the Eurostat data, in 2017, 6,7 % of polish households spent 40 % or more of their equivalised disposable income on housing [20].

2. The original formula for the housing availability index is the quotient of the average monthly wage in the enterprise sector and the transaction price. It expresses the number of square meters of housing that can be purchased for an average wage in the enterprise sector in a particular city, at an average transaction price in a particular market".