



## Article

# Influence of the COVID-19 Crisis on Steel Production in Poland Compared to the Financial Crisis of 2009 and to Boom Periods in the Market

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**Abstract:** This paper presents an analysis of the volume of steel production in Poland during the COVID-19 crisis in the first half of 2020 in comparison to the volume of steel production during the financial crisis initiated in the US during the period 2007–2008, whose effects, in the form of a large decrease in steel production, were seen in 2009 in Poland. A comparison is also made to periods of prosperity in 2004, 2007, and 2017 (when there was a good economic situation in the steel market in Poland). The selection of the time period—the first half of 2020—was based on the emergence of a new situation in the economy, which was lockdown. The aim of the analysis is to determine the impact of the COVID-19 situation on the steel market (volume of steel production) in Poland. The analysis performed could help entrepreneurs manage their companies during the COVID-19 crisis. This paper belongs to the category of research work. The statistical analysis was realized regarding steel production in Poland. Three periods were analyzed: The first half of 2020—the period termed the COVID-19 crisis; the year 2019—the year of a large decrease in steel production in Poland caused by the world financial crisis; and periods of prosperity in the steel market—the years 2004, 2007, and 2017 (periods before crises). The analysis shows that, in order to assess the impact of the COVID-19 crisis on the functioning of enterprises or industries, it is necessary to analyze the situation and compare it with other situations in the past. Moreover, crisis management in the COVID-19 situation must be highly rationalized and real, and the various industrial sectors and companies forming them should adapt this process to their own situation. Results: On the basis of the statistical data, it was found that, in the short term (months), the production of steel during the COVID-19 crisis was a little higher than in the financial crisis of 2009 (excluding steel production in June 2020), and lower than during the boom in the steel market (the comparison to the periods when there was a boom in the Polish steel market was made to show the dynamics of decline).



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## 1. Introduction

With the spread of SARS-CoV-2 (a new virus in humans that causes respiratory illness that can be spread from person to person), economic, social, commercial, communication, and tourist restrictions, among other restrictions, have been applied in many countries worldwide. On 30 January 2020, the COVID-19 pandemic was recognized by the World Health Organization (WHO) as a serious global health threat. COVID-19 was identified in Wuhan, China, in December 2019. The first COVID-19 patients from outside China were registered on 13 January 2020 in Thailand. On 24 January 2020, the first patients with COVID-19 symptoms were diagnosed in France (the first European country). On 11 February 2020, the World Health Organization announced an official name, COVID-19, for SARS-CoV-2. On 4 March 2020, the first patient with symptoms of SARS-CoV-2 was registered in Poland. On 11 March 2020, the WHO declared COVID-19 to be a pandemic. This meant that the disease had spread worldwide, and it is the first time that a coronavirus has led

to a pandemic [1]. The experiences of countries such as China, Italy, the United States, and Spain have demonstrated that COVID-19 has burdened health systems, regardless of available investments and resources [2–6].

Authorities and governments have adopted several forms of physical distancing as a public health measure to contain the dissemination of the new coronavirus. One of these measures has been lockdown. The lockdown has resulted in the supply chain being broken, demand for industrial goods falling, and the decline of industrial production. Analysts have referred to the market changes during the COVID-19 period as “the shock of demand” and “the shock of supply” [7,8]. The supply shock was influenced by the closure of some factories and the breaking of the supply chain. The demand shock was influenced by the closure of shops and warehouses. In many economies of the world, GDP declined. In the EU (27) (EU 27 means all European Union countries including United Kingdom), the change in GDP (1st quarter, 2020) was  $-2.6\%$  (GUS—Main Statistics Bureau in Poland/Statistics Poland, 2020). The biggest decreases in GDP were in Italy ( $-5.4\%$ ), France, ( $-5\%$ ), and Spain ( $-4.1\%$ ). In Poland, the change in GDP was  $1.7\%$  [9].

Other economic indicators were also unfavorable. Examples include the basic indicators for Poland in June 2020: Sold production of industry and retail sales were lower than a year before (sold production: Seasonally unadjusted was  $+13.9\%$  m/m (month over month) and  $+0.5\%$  y/y (year over year), but seasonally adjusted was  $+9.7\%$  m/m and  $-4.9\%$  y/y); retail sales ( $+8.4\%$  m/m,  $-1.3\%$  y/y); average paid employment in the enterprise sector declined in relation to the first half of the previous year (in full-time equivalents it was  $+0.2\%$  m/m and  $-3.3\%$  y/y); the registered unemployment rate grew in annual terms (as of the end of the period it was  $6.1\%$ ); manufacturer prices in industry were lower (down  $0.8\%$  y/y); and foreign trade (in PLN—abbreviation for Polish currency zloty) during the period January–May 2020 declined in comparison to 2019 (exports:  $-7.4\%$  y/y; imports:  $-9.6\%$  y/y). Moreover, both business climate indicators and consumer confidence indicators also declined (manufacturing:  $10.5\%$ , construction:  $-16.7\%$ , retail trade:  $-12.2\%$ , transportation and storage:  $-14.3\%$ ; consumer confidence indicators: current  $-13.4\%$ , leading  $-13.7\%$ ) [9]. Enterprises in the majority of areas still assess the business climate unfavorably (except for information and communication entities). Entrepreneurs expect that the negative effects of the COVID-19 pandemic in the coming months will still be noticeable and serious. The majority of companies still declare the necessity for the implementation of certain actions to reduce the negative effects of the pandemic. The buildup of economic disadvantage for economies and industries has been called the COVID-19 crisis. McKinsey has prepared a special report on the impact of the coronavirus on the global economy and on businesses [8]. The McKinsey report is updated on an ongoing basis. Analysts predicted two scenarios of developments: Either the virus is seasonal and the number of patients will soon fall (positive scenario), or the virus is not seasonal and there will be an increase of patients (negative scenario) [8]. In the negative scenario, there will be a deepening economic crisis and an economic recovery will only take place next year at the earliest. A large drop in demand and investment could lead to a deep recession [7,8].

During the COVID-19 crisis, the governments of many countries implemented anti-crisis programs. In Poland, the program was called an “anti-crisis shield” and was based on five pillars: Defending against job losses, support for the health service, security of the financial system, support for entrepreneurs, and public investment [9].

COVID-19 has hit many industries, in both obvious and not so obvious ways [10,11]. The steel sector, for one, is reeling from falling demand because cars are not being produced and steel consumption has therefore declined compared to 2019. The coronavirus has hit the entire world steel industry. In 2019, 437 million tons of steel were sold on the international market. This was the lowest volume since 2013 [12–16]. Global crude steel production decreased by  $1.4\%$  in the first three months of 2020 compared to the same period in the previous year. In June 2020, global crude steel production was 148.3 million tons, a  $7\%$  decrease compared to June 2019 [13]. In the period from January to September 2020, crude steel production—in the top 20 countries—was 1351 million tons ( $-3\%$ ). Here are

examples of production declines in some countries and regions: Japan: −19%; India: −16%; EU: −18%; USA: −19%; Argentina: −30%, RPA: −41% [16].

The Eurofer forecasts that demand for steel in the EU will fall by a few percentage points in the coming years with a global surplus of more than 400 million tonnes in the steel sector [17]. In UE in the period from January to September 2020, crude steel production was 99 million tonnes (−18% y/y) [16]. The biggest declines in raw steel production were in France—27% and Spain −26% [16].

In Poland, in the period from January to July 2020, crude steel production was 4.7 million tonnes. Total steel production (for 12 months of 2020) was 7.8 million tonnes. In January and February 2020, crude steel production was above 700 thousand tonnes each month. In the following months (March to June), steel production decreased. The increase was again recorded in July 2020, when production again amounted to more than 700 thousand tonnes. The volume of steel production in Poland for 2020 has not been formally confirmed by the world and European institutions, therefore sometimes different information, e.g., in June 2020, crude steel production was 615 thousand tonnes [18], but the Polish Steel Association informed about 638 thousand tonnes of raw steel in June 2020 (information from steel mills). Authors in this analysis used statistics that were corrected based on comparisons of information from different sources.

In the first months of 2020, indicators for the steel industry in Poland were lower than in the previous year [15]. Particular countries had a decline in steel production in June, excluding three countries: Turkey, Ukraine, and China, where steel production increased in June 2020 [19]. In the period from January to September 2020, the list of countries (top 20) where steel production increased were: China +5%, Vietnam + 21%, Turkey + 3%, Iran + 11%, and Egypt + 7% [16].

In 2020, the Worldsteel Association forecasted that steel demand would contract by 6.4%, dropping to 1 654 million tonnes due to the COVID-19 crisis (the forecast was published in June 2020 by the Worldsteel Association) [19,20]. Steel demand in the developed economies was expected to decline by 17.1% in 2020. In developing countries, steel demand (excluding China—Chinese steel demand was expected to increase by 1.0% in 2020) was expected to fall by 11.6% in 2020 [19]. EU steel demand suffered a contraction of 5.6% in 2019 due to the sustained manufacturing recession [17].

The situation in the steel sector was influenced by the situation in the steel-consuming sectors. Automotive manufacturing, one of the largest consumers of steel, has been curtailed in an effort to slow the spread of COVID-19, while falling energy prices have led to much lower demand from sectors like oil and gas. Large automotive manufacturers such as Volvo, Toyota, VW, Nissan, and Seat have reduced production since the COVID pandemic. In April in Poland, the decrease in car production was 80% compared to April 2019 [20]. The dynamics of the decrease in production (number of cars produced) between January and October 2020 in the automotive sector were—34% (y/y). The situation in other industries (steel consumers) was also not good, e.g., production of large home appliances decreased by 1.2% compared to the period from January to October 2019, and the production of machinery and equipment decreased by 13% over the same period [21].

Companies implemented anti-crisis programs. To survive and minimize losses, companies analyze and model data to gain useful information, create anti-crisis teams, and cut expenses. The business strategies have been strongly changed from an optimistic (the best-case scenario) to a pessimistic (the worst-case) scenario.

No crisis lasts forever. History shows that every economic crisis has an end. In the modern world history, the 2008 financial crisis was the worst economic disaster since the Great Depression of 1929. The causes of the crisis in 2008 were the deregulation of financial derivatives. The financial crisis of 2008–2009 influenced industries in many countries. In 2009, in Poland, steel production was less than in 2008 (down 24% and down 33% compared to 2007). Apart from the crises in the steel market, there were also periods of prosperity (steel boom). In the Polish steel industry, the largest production volumes were in 2004, 2007, and 2017 [14].

On the basis of the information presented, it seems to be important to perform data analysis in order to generate knowledge about the steel production volume in the COVID-19 crisis period and to perform comparative analyses to the period of the financial crisis and periods of prosperity. It is also a good idea to present the dynamics of production: month on month, quarter on quarter, first half-year on first half-year. The paper presents the results of such an analysis. The purpose of this paper is to compare the volume of steel production in Poland in different periods and to expand the knowledge about the situation in the Polish steel industry in the COVID-19 crisis.

## 2. Literature Review about Crisis Management

British Standards Institution in PAS 200:2011: Crisis Management: Guidance and Good Practice (PAS: Publicly Available Specification, PAS 200:2011, is a standard designed to help organizations take practical steps to improve their ability to deal with crises) defines crisis as an inherently abnormal, complex, and unstable situation that represents a threat to meet strategic objectives, existence, or reputation of the organization [22]. The crisis affects the functioning of companies that carry out crisis management. Crisis management is the process by which an organization deals with a disruptive and unexpected event that threatens to harm the organization or its stakeholders [23]. Crisis management is important because many situations occur in the world that can affect organization functioning [24]. From an organizational point of view, organizational crisis is a high-impact, low-probability event that threatens the functioning of the organization. The crisis is characterized by ambiguity of cause, effects, resolution, and means, and also a belief that the decision to solve the problem must be made swiftly [25]. It's especially very important in the times of COVID-19 pandemic. Especially big corporation and industries to survive crisis should be managed effectively [26]. A crisis can occur on a personal or societal level. It may be connected with a stressful or traumatic change in life or a dangerous or unstable social situation in economic, political, social, or military affairs. It can also be a large-scale environmental event which involves an impending abrupt change. Additionally, it can be named as a "testing time" or emergency event [27].

We can differentiate many types of crisis like poverty-related, unemployment, economic crisis, financial crisis, environmental crisis, and international crisis. There are different types of crisis. Most often, a classification is influenced by the cause of the crisis or its effects [28]. We described it briefly in Table 1. Those types of crisis are related between themselves. In the first decade of this century, organizations struggled with the effects of the financial crisis that started in the US in 2007. The causes of the crisis were the deregulation of financial derivatives in the US. The peak of the crisis in the world was in the years 2008–2009. The financial and banking crisis of 2008–2009 influenced industries in many countries and their industries. The next crisis began in 2019 (ten years after the previous one) and was caused by the COVID-19 virus pandemic. COVID-19 crisis is a natural disaster (according to Lerbinger's classification) in the category of an environmental crisis. This crisis affected all the world and because of that, it's an international crisis. Because of its harmful effect on business, it can lead to unemployment and financial crisis. If it will last longer, it may lead to an economic crisis, and in some countries also poverty-related crisis.

There are two broad perspectives on crisis management. The first perspective according to Dayton is operational, and the second is political-symbolic [37,38]. The first one—operational focuses on managing the crisis itself, the second one—political-symbolic, includes a particular map of how managers and rest of the organizational team analyze crises [30].

**Table 1.** Main types of crisis—fundamental categories of crises.

Type of Crisis	Characteristic
Poverty-related	This type of crisis includes malnutrition—the lack of sufficient nutrients which are necessary to maintain health. Is typically associated with poverty in economically undeveloped countries.
Unemployment	The condition of willing workers lacking a job. It leads to difficulties with meeting financial obligations such as food purchasing to feed family, pay one’s bills, failure to pay mortgages, etc.
Economic crisis	The term economic crisis is related to the sharp transition into recession. The crisis period encourages class conflict and/or societal changes. Includes events such as market crashes, strikes, and shortages of labor opportunities.
Financial crisis	Problems of banking systems like: Banking crisis, speculative bubbles and crashes, or international financial crisis.
Environmental crisis	Environmental disaster—this type of crisis is a disaster due to human activity. Natural disaster—is the consequence of existing natural hazard (for example, volcanic eruption, landslide, or earthquake) which changes its phase from potential to active. The resulting loss depends on the capacity of the population to resist or support the disaster and their resilience.
International crisis	Crisis when the situation has far-reaching consequences affecting a whole or big part of the world.
Informational	The crisis is in situation of lack of important information or some organizational records which are public or confidential.
Physical	This type of crisis is connected with equipment problems, loss of supplier, or also big disruption of a key operating plant.
Human resources	The crisis occurs, for example, when we affect the loss of a key executive member of an organization, workplace violence, or vandalism.
Reputational	The term is related to rumors or gossips which can negatively affect the reputation of the organization.

Source: On basis: [28–36].

To deal with crisis management, we should use an integrated, holistic approach. We should take into consideration that not all crises are preventable [33]. However, we should try to manage them to restrain the number of negative effects they can bring. To increase crisis resistance of the company, we should implement a procedure consisting of the following steps [39]:

- Risk assessment,
- risk management,
- crisis preparedness assessment,
- emergency and crisis response,
- reputation management,
- training,
- testing,
- monitoring and evaluation.

To manage the crisis, we should take into consideration the main factors affecting it. The most important factors are [40]:

- Psychological, which are connected with the important element for the individual in charge of a crisis management process,
- the good knowledge about the whole environment surrounding the organization,
- the knowledge about the nature of local laws and legislations,
- good communication and a media plan to connect with the public in a time of crisis, and
- involving the public in the crisis.

Three elements are common to all crises: A threat to the organization, the element of surprise, and a short decision time [41]. The classical model of crisis management developed by Gonzales-Herrera and Pratt [42] consists of the four following stages: Issues management, planning-prevention, the crisis, and the post-crisis, or based on Bundy



classification, only three stages: Pre-crisis prevention, crisis management, and post-crisis outcomes [23]. Sometimes the crisis surprises organizations and they cannot realize the first stage (pre-crisis prevention). The planning for a crisis is very troublesome because it is a low-probability event. This type of event is hard to plan for earlier, and the organization is unprepared for it. In times when all is going well, organizations hardly ever want to plan for something bad [43,44]. Because the crisis has a high-damage impact, it has a devastating effect on the organization. The organization can be badly wounded or even killed by the crisis. The crisis has the ambiguity of cause, which means that the origins and effects of the crisis may not be known initially [33]. Additionally, the resolving of a crisis is not easy and often debatable. Several viable options can be available for crisis management to mitigate it, and it's not easy to choose the proper one. Additionally, a certain aspect of a crisis may require a swift decision to manage. It's a problem to act decisively during the crisis [44]. The crisis can lead to an immense amount of negative consequences for the business. It's not easy to analyze risks and to make an appropriate decision regarding them, but it's necessary to generate the required level of security. Accidents and crisis occur because those who manage very complex systems are not sufficiently able to anticipate the problems generated by those systems [45]. Events such as hurricanes, earthquakes, tsunami, winter storms, power outages, and now viruses have underscored organizations' vulnerability to natural disasters. Additionally, there can be many types of disastrous incidents affecting organizations which are man-made, like: Cyber-attacks, terroristic activities, failing infrastructure, financial crises, energy shortages, and crime [46,47].

Before a crisis occurs, it can send many early warning signals, which announce the possibility that a crisis will take place [48]. However, it's not easy to recognize those subtle signals. We can distinguish the following limitation of the common crisis warnings [41]:

- To subtle or too weak signals,
- the sources of crisis signals are not viewed as credible,
- the signals are imbedded in routine messages, or
- the signal can't reach the appropriate persons.

Many of these sources we could observe in the first phase of the COVID-19 pandemic as well. The signals were firstly weak and not all oriented around the situation. The signals were underestimated, and the whole situation went out of control. In Table 2, we described reasons why an organization does not engage in proper crisis management with conceptions to the COVID-19 pandemic.

**Table 2.** Reasons why organizations do not engage in proper crisis management.

Reason	Definition	COVID-19 Pandemic
Denial	The organization tries to deny that it may be vulnerable to threats of imminent crisis and decide there is no need to take measures.	Many people first tried to deny the COVID-19 pandemic as a whole. Next, they underestimated the possibility of widespread of it.
Disavowal	The organization recognizes that a crisis can affect it, but think that the impact will be too low to be taken into consideration. The organization diminishes the magnitude and importance of the crisis.	When the authorities and organizations' realized that the COVID-19 pandemic was real, they tried to deny the possible effects—mortality, and the potential business effects of a pandemic. They thought that it could have a small and short-lasting effect.
Grandiosity	The organization tries to presume that is too powerful and big to be affected by the crisis.	In the big international crisis, all organizations were affected. Especially, the closing of many international borders had a very negative effect on supply chain management in a business environment.
Idealization	The organization thinks that the crisis does not happen to good organizations, and because of that ignores all existing signals of a crisis.	The international range of the COVID-19 pandemic affected almost all organizations in the world.

Table 2. Cont.

Reason	Definition	COVID-19 Pandemic
Intellectualization	The organization minimizes the probability of occurrence of the crisis.	For many years, scientists have warned about the possibility of pandemic occurrence. We have known a previous disaster, for example, the Spanish flu pandemic in 1918. However, many thought that today, in a highly developed world, such a situation is impossible.
Compartmentalization	The organization believes that even if a crisis occurs and affects the company, it will affect only small part of it.	The global dimension of the pandemic affected all branches of companies and had a very big impact on business.

Source: Author's own work based on: [34,49,50].

In the steel industry, crisis management methods were used many times when bigger and smaller crises occurred. In a crisis situation in this industry, a modification of a total change of action strategy is needed. The changes can be in organizational structure, investment, production, and improvement of efficiency by controlling cost and stringing the discipline of work [24]. Additionally, in the COVID-19 pandemic situation, the changes are needed. In this publication, we showed the influence of the steel industry situation. This effect will probably lead to many changes in the industry organization, especially if the pandemic situation will last longer [51]. The COVID-19 crisis will impact many areas of work. In Table 3, we described the main impacts of the disease from a management point of view.

Table 3. COVID-19—changes for workers.

COVID 19 Pandemic Impact	Characteristic
Unemployment and layoffs	Many types of industries, especially travel, hospitality, entertainment, and sports, were shut down by the current pandemic. Many people in the whole world are unemployed, which affects their state of life and leads to anxiety, depression, and physical ailments.
Presenteeism	It is the risk that people continuing to work in COVID-19 are going to work ill and can infect other people.
Economic inequality	Scholars expect that economic inequality can increase in the time of COVID 19 pandemic. Such problems were known in times of past crises, for example, the financial crisis in 2008.
Social distancing and loneliness	Problems connected with a low amount of social contact can negatively influence on social and mental physical health. Loneliness is an emotion which is psychologically painful and results from subjective feelings that their social needs are not well met.
Stress and burnout	The uncertainty affected by pandemic can lead to an increase in those problems between various industries.
Addiction	Other problems with workforce disengagement were associated with alcohol misuse due to distancing from workplace-based supervisors and peers. The COVID-19 pandemic can bring similar effects.

Source: On basis: [52–63].

### 3. Data and Methods

Data analysis is the process of data processing to obtain useful information and conclusions on its basis. Depending on the type of data and the problems posed, different statistical methods can be used [64–66]. Data analysis—the volume of steel production in Poland—consisted of checking, organizing, transforming, and reporting data to obtain useful information and develop conclusions. The analysis was carried out according to these steps:

- Defining the analysis requirements,
- data collection,

- data processing,
- proper data analysis, and
- reporting of results.

In research, the authors used comparative analysis. Comparative research methods are used extensively in consumption and management. Such analyses are carried out: Management comparative research, marketing comparative research, and cross-cultural and cross-discipline comparative research. The condition for its application is the comparability of the subject [67]. Through different forms of comparison, the reader can better understand the subject of the research. A comparative analysis is a good introduction to further research because it organizes the subject of research. The authors applied a period of comparison. The studies were carried out using a comparative analysis of the production volume of steel produced in Poland for three periods:

- (1) COVID-19 (the first half-year of 2020),
- (2) the financial crisis (the first half-year of 2009), and
- (3) the boom in the steel market (the first half-years of 2004, 2007, and 2017).

The analysis periods were half-yearly in each period. The first argument for choosing the half-yearly period 2020: The specific (difficult) situation related to COVID-19 begins in Poland in March and increases until June because there was the lockdown in the Polish economy in that period. The second argument: The period from January to June 2020 was called “the first wave of COVID-19”, the next one appears at the end of the year as the second phase of the increase in the number of COVID patients. Moreover, the economic restrictions introduced in Poland (and other countries) between March and June of 2020 surprised producers, so it is worth checking for changes in steel production in Poland. Besides, the decrease in crude steel production in Poland between January and June 2020, called the Covid-19 crisis, must be compared with the financial crisis that was on the Polish steel market in 2009 (the second period of analysis), to develop knowledge about crises in the market, although the conditions of this crisis are different. For the third period, the argument is as follows: The comparison to the boom periods in the market shows the dynamics of change in crude steel production in Poland.

Quantitative data—the volume of crude steel production in Poland—have been compiled every month. For 2020, due to the lack of data, a time limit has been adopted. In 2020, data about steel production were from January to June. The analysis was based on data obtained from the Polish Steel Association in Katowice. The analysis was performed in August 2020. Data collected in spreadsheets has been processed using Excel tools. The results of the analysis are presented in tables and presented in figures. The statistics about crude steel production in Poland for the period from August to December 2020 are recorded in Table 4. These figures should be treated, especially for the last months of 2020, as forecasts because the formal confirmation of steel production figures for the last quarter of 2020 will be in the first months of 2021.

**Table 4.** Statistics on crude steel production in Poland [thousand tonnes].

Years	January	February	March	April	May	June	July	August	September	October	November	December
2004	880	827	887	926	933	914	947	909	877	927	796	769
2007	907	860	948	906	957	967	872	847	859	859	829	819
2009	492	483	473	479	569	677	697	686	669	747	607	551
2017	852	796	855	891	881	853	912	846	865	871	821	888
2020	720	720	658	671	637	638	700	505	599	692	660 F	630F

Description: F—forecast.  —Data used for analysis only from January to June (colour).

Two forms of analysis were used:

- Static data analysis,
- dynamic data analysis.



Formula for dynamics [68]:

$$D_P = \frac{(P_t - P_{t-1})}{P_{t-1}} \times 100\% \quad (1)$$

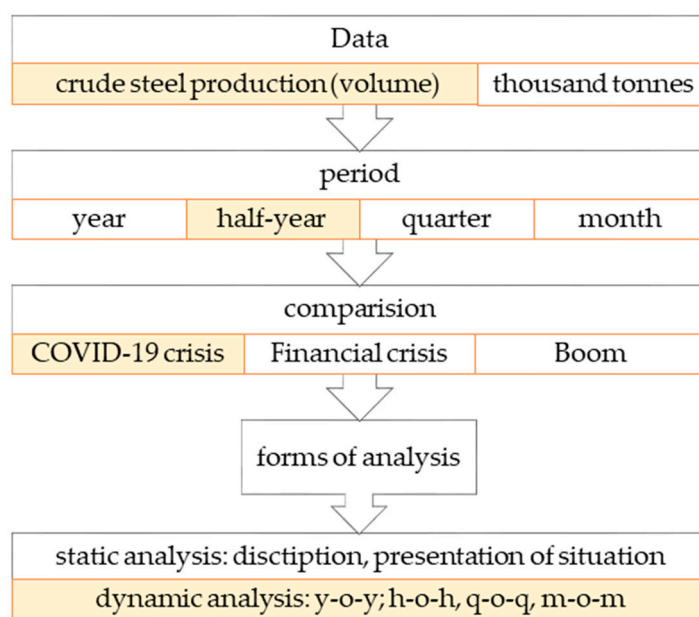
where:

$D_P$ —dynamics of steel production;

$P_t$ —crude steel production in the current period;

$P_{t-1}$ —steel production in the previous period.

The whole structure of analysis was presented in Figure 1.



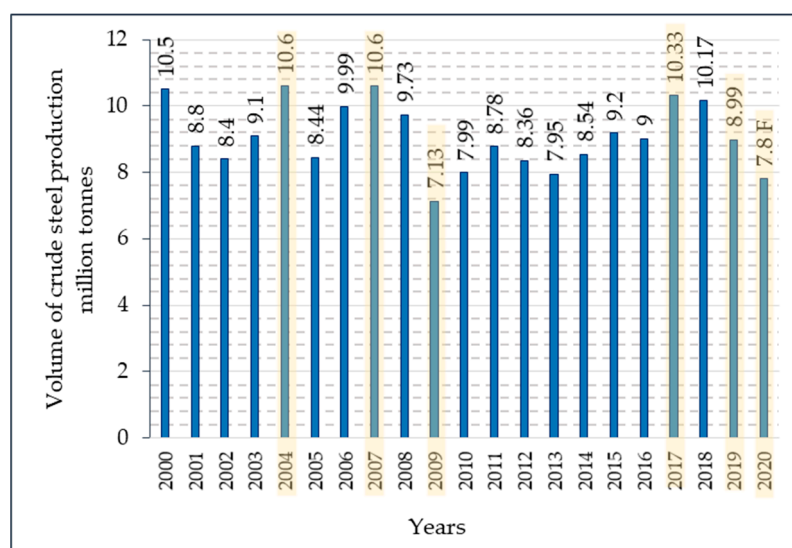
**Figure 1.** The structure of analysis presented in the paper. Description: y-o-y means: year over year, h-o-h means half year over half year, q-o-q means quarter over quarter, m-o-m means month over month.

#### 4. Research of Analysis: The Volume of Steel Production in Poland Periods

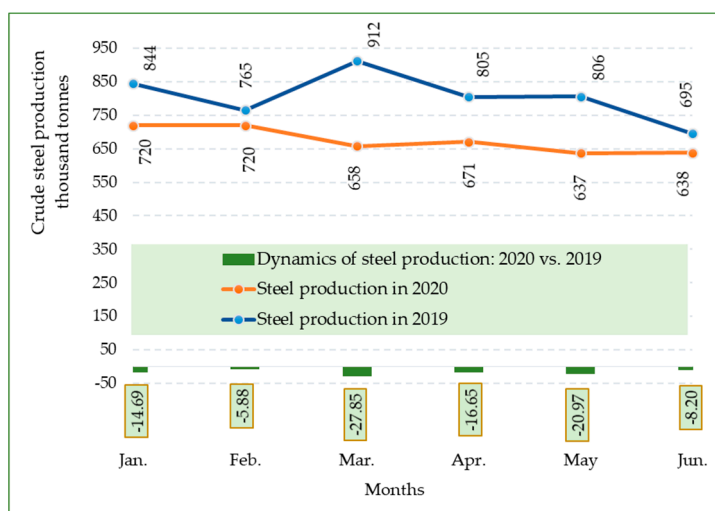
The market situation in the country and the world affects the volume of crude steel production in Poland. In the years 2000–2020, there were both increases and decreases in the volume of steel production in Poland (Figure 2). During this period, the largest decrease was in 2009, and the largest increase in 2007. The situation on the steel market in Poland was also good in 2004 and 2017. In 2009, steel production was 7.129 million tonnes. In the same decade, in 2004, the steel production was 10.593 million tonnes, and in 2007, the steel production was 10.632 million tonnes, the highest production volumes in Poland after the restructuring of the smelters and their privatization. The next high volume of crude steel production in Poland was only 10 years later. In 2017, steel production in Poland was 10.33 million tonnes [69]. In 2020 (F—forecast), steel production dropped by more than 1 million tonnes as compared to 2019.

In the period from January to June 2020, 4 million tonnes of crude steel were produced in Poland, a decrease of 16% as compared to the first half of 2019. The average utilization of the production capacity was by a few percentage points lower than in the previous year and amounted to 74%. The lowest steel production was recorded in March 2020 compared to March 2019; the decrease was 28%. In March 2019, 912 thousand tonnes of crude steel were produced in Poland, and in March 2020, 658 thousand tonnes. March was the first month of introducing radical restrictions in Poland due to the appearance of patient zero. Data regarding the steel production in Poland (volume) in the period from January to June

2020 with its dynamics (Formula (1)) compared to the same period in 2019 are presented in Figures 2 and 3.

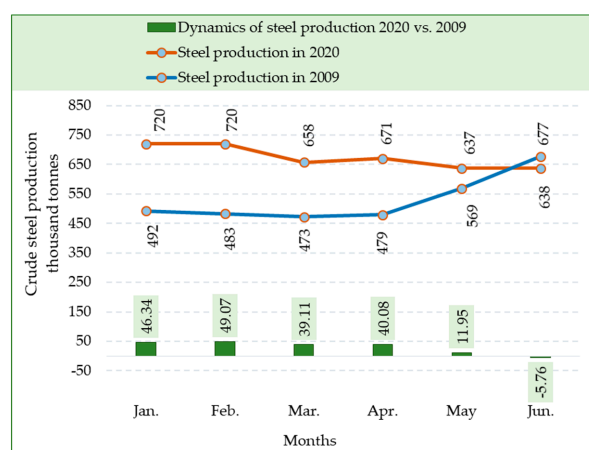


**Figure 2.** Crude steel production in Poland from 2000 to 2020. Source: Own study based on data from Polish Steel Association [69].



**Figure 3.** Crude steel production and its dynamics in the first half of 2020 and the first half of 2019. Source: Own study based on data from Polish Steel Association [69].

Figure 4 shows the monthly volume of steel production in the first half of 2020 as compared to the same period of 2009 (the financial crisis from the US in the world) and its dynamics. Based on the analysis, it was established that the monthly volume of steel production in Poland in the period from January to June 2020 was higher than in the same period of 2009. Only in June 2020, the dynamics of steel production were falling (−5.76%). The average steel production in the period was 674 thousand tonnes (per month). In 2009, the average steel production was 529 thousand tonnes, so in the COVID-19 crisis, steel mills produced more than in the financial crisis. Data regarding the production volume of crude steel in Poland in the first half of 2020 as compared to the first half of 2009 are presented in Table 5.



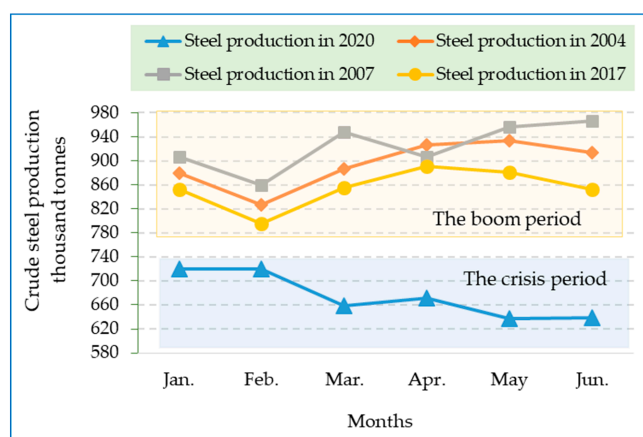
**Figure 4.** Crude steel production and its dynamics in the first half of 2020 and in the first half of 2009. Source: Own study based on data from Polish Steel Association [69].

**Table 5.** Manufacturing of crude steel in Poland in the first half of 2020 compared to the first half of 2009.

		January		February		March		April		May		June		
2020	Thousand tonnes m-o-m	720	46.34%	720	49.07%	658	39.11%	671	40.08%	637	11.95%	638	-5.76%	
2009		492		483		473		479		569		677		
The first quarter						The second quarter								
2020	Thousand tonnes q-o-q	2098				44.89%				1946				12.81%
2009		1448				1725								
The first half-year														
2020	Thousand tonnes h-o-h	4044						27.45%						
2009		3173												

Note: m-o-m—month-on-month; q-o-q—quarter-on-quarter, h-o-h—first half-year-on-first half-year. Source: Own study based on data from Polish Steel Association [69].

On the other hand, the comparison of steel production volume in Poland in the COVID-19 period to steel production in the period of increasing steel demand is unfavorable. The dynamics of change are declining. Data regarding this are presented in Table 6, and trends are presented in Figure 5. The trend for the crude steel production in the COVID 19 crisis is strongly declining in comparison to the periods with the boom in the steel market.



**Figure 5.** Steel production and its trends in the first half of 2020 and in the first half of 2004, 2007, and 2017. Source: Own study based on data from Polish Steel Association [69].

**Table 6.** Manufacturing of steel in Poland in the first half of 2020 compared to the first half of 2004, 2007, and 2017.

Months						
	January	February	March	April	May	June
	Thousand tonnes					
2020	720	720	658	671	637	638
2004	880	827	887	926	933	914
2007	907	860	948	906	957	967
2017	852	796	855	891	881	853
2020/2004 m-o-m	−18.18%	−12.94%	−25.82%	−27.54%	−31.73%	−30.20%
2020/2007 m-o-m	−20.62%	−16.28%	−30.59%	−25.94%	−33.44%	−34.02%
2020/2017 m-o-m	−15.49%	−9.55%	−23.04%	−24.69%	−27.70%	−25.21%
Quarters						
	The first quarter			The second quarter		
	Thousand tonnes					
2020	2098			1946		
2004	2594			2773		
2007	2715			2830		
2017	2503			2625		
2020/2004 q-o-q	−19.12%			−29.82%		
2020/2007 q-o-q	−22.73%			−31.24%		
2020/2017 q-o-q	−16.18%			−25.87%		
First half of the year						
	Thousand tonnes			Dynamics h-o-h		
2020	2004	2007	2017	2020/2004	2020/2007	2020/2017
4044	5367	5545	5128	−24.65%	−27.07%	−21.34%

Source: Own study based on data from Polish Steel Association [69].

Based on the data collected in Table 6, it was found that the largest steel production was in the first half of 2007 (5.545 million tonnes). In June 2007, the crude steel production was 967 thousand tonnes, the most of all the data collected monthly, so the highest decrease in monthly steel production was in June 2020 as compared to June 2007 (−34.02%).

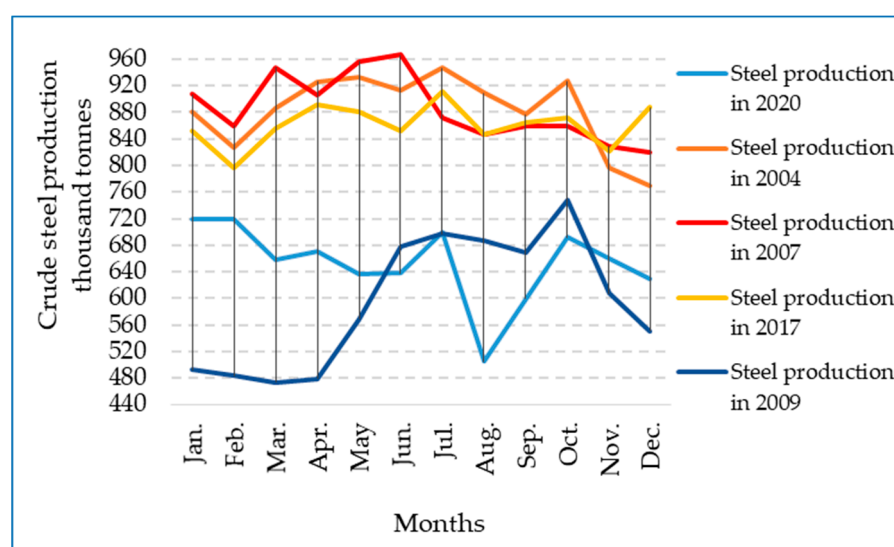
## 5. Discussion

In our paper, we wanted to analyze the steel production in Poland in times of COVID-19 crisis and compare it to the financial crisis from 2008–2009. The COVID-19 crisis is an informational type of crisis and environmental type of crisis. In any organization, this crisis has affected many workers and organizations [26–34].

Based on our analysis, we found that the COVID-19 crisis has affected the steel industry in Poland. We observe the decrease in steel production from the point the crisis started in Poland (March 2020). Additionally, other publications about the industry are according to our results. The world report about manufacturing production noted a big decrease in production in the first part of 2020 [19,20,70]. There is also a similar situation in

the Asian Agriculture industry. In southeast Asian countries, the volume of production decreased in all countries from this region [71]. Additionally, other authors [72,73] think the current COVID-19 crisis has a big negative impact on the economy and production volume in many industries. We think that the Polish example could be interesting for other countries not only producing steel, but also other industrial goods. The crises that we compared in our paper were international crises, and we think the analysis of particular industrial goods in a particular country can give a good database for meta-analysis. Our paper is a case study, but it can give useful information for other countries producing steel, and can in the future be part of the bigger meta-analysis.

When we analyze the situation in Polish steel production in other non-crisis-affected years, we can observe that there are no differences between particular months bigger than 5%. The volume of production is rather stable. But in a situation of crisis, it tends to decrease (Figure 6).



**Figure 6.** Steel production in years: 2020, 2004, 2007, 2017, and 2009. Source: Own study based on data from Table 4 [69].

The decrease in the COVID-19 crisis comparing to the boom period is more than 20%. The volume of production from February to June 2020 decreased by about 12% due to a crisis. This crisis affected the steel industry in Poland almost as hard as the financial crisis in 2008–2009. In 2008–2009, we also observed a big decrease in steel production, even harder than now (decrease to 473 thousand tonnes per month compared to 658 thousand tonnes per month in COVID-19 crisis). However, this year the decrease is the second biggest in the years 2000–2020. This situation is very bad from the industry point of view, especially now that we know that the crisis is lasting, and if will last for a year or more, it could affect the steel industry very hard. Our results are according to OECD data for the global steel market. In the global market, we could also observe the decrease in steel production due to the COVID-19 crisis [16]. We think it is not possible that the effects are incidental. Always when we can observe the big crisis in the world market (crisis can have financial or other reasons), there is a big decrease in steel production. There was not a similar crisis in the market in the years 2000–2020 not connected with such a situation. The analyzed industry (Polish steel production) can use different scenarios in the market, when there is a boom in the steel market—the best-case scenario of steel production with production above 9 million tonnes until 10 million tonnes per year, when there is the crisis—the worst-case scenario—the production falls below 9 million tonnes (and even below 8 million tonnes) [74,75]. The Polish Steel Association predictions were on the level of 7.8 million tonnes of produced steel for 12 months of the 2020 year [21]. In an analysis of steel production, we can use also different comparative



factors for example foreign trade (exports and imports of steel products, apparent and real steel use) [76,77].

Because effects of the financial crisis and COVID-19 crisis are similar from the Polish steel industry point of view, we could think that the basis of the problem is the decrease of demand due to a crisis [78]. To deal with the problem, organizations should use proper crisis management methods to particular tasks [50,79], but it's not sufficient. The organizations should also wait for an increase in demand to deal with the problem. In the financial crisis in 2009, this increase of demand was rather bid and fast, but if it would be so in COVID crisis, for now, we can't say properly. However, the whole situation can affect workers because they should implement a new way of work based more on teleworking and distancing [80]. The strongly dynamic environment in recent years forces managers to think in a new way, that we should analyze the risk of the development of the company in the management process [81].

The COVID-19 crisis has appeared in the information society. Digitation helps us to live better in the COVID-19 situation [82], but lockdown have many bad effects on our lives and economies [80]. The COVID-19 crisis takes place in times of the popularization of the Industry 4.0 concept. This can be the reason that there is a dissonance in our lives, and the additional question can be formed thus far to societies and economies [83]. The COVID-19 situation is a global problem for all industries and it must be analyzed in the case of many topics: Economies, societies, enterprises. The more different analyses we can do, the better we can understand the impact of the COVID-19 crisis. For the whole world, this is a new situation, and we have to face it.

## 6. Conclusions

Based on the analysis, conclusions were drawn:

- In the first half of 2020, the steel production in Poland was 4.044 million tonnes,
- the steel production in the first half of 2020 decreased, as compared to the same period of previous year, the highest decrease was in June 2020 compared to June 2007 (−34.02%),
- the steel production in the COVID-19 crisis as compared to the boom periods is heavily declining (decrease more than 20% compared to the periods of steel boom),
- the production of steel in the COVID-19 crisis (month) is a little higher than in the financial crisis of 2009 (excluding steel production in June 2020),
- the production capacity of the steel industry in Poland in the COVID-19 crisis is unused, Polish steel mills can produce about one million tonnes per month, and the highest level of steel production was 967 thousand tonnes (June 2007),
- the average monthly production in the period from January to June 2020 was 674 thousand tonnes, and in the financial crisis of 2009 was 529 thousand tonnes (increase 27.45%), and
- only the financial crisis has had harder effects on steel production industry in Poland, but the COVID-19 crisis is not finished, and if it will last longer, it could be even worse.

The analysis shows that to assess the impact of the COVID-19 crisis on the functioning of enterprises or industries, it is necessary to analyze the situation and compare it with other situations that were in the past. Historical data is useful for crisis management. Crisis management in the COVID-19 situation must be highly rationalized and real, and the various industrial sectors and companies forming them should adapt this process to their situation.

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