

**ANALYSIS OF RAW MATERIAL SUPPLY-DEMAND RELATIONSHIP USING N-GRAM:
CHROME MINE EXAMPLE***N-GRAM KULLANILARAK HAMMADDE ARZ-TALEP İLİŞKİSİNİN ANALİZİ: KROM MADENİ ÖRNEĞİ***Assoc. Prof. Dr. Alaaddin VURAL***Gümüşhane University, Faculty of Engineering and Natural Sciences, Department of Geological Engineering,
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ORCID: ID/0000-0002-1273-4867***ABSTRACT**

Depending on the strategic importance of the substance, the supply-demand relationship of the raw material has become remarkably important during the times of crisis. The type of raw material played an important role in this relationship from time to time. After the Industrial Revolution, some raw materials, especially in heavy industry and defense industry, became important due to their geography and the effect of the reserve amount. In some cases, issues such as supply security of these raw materials have caused serious security concerns and have even threatened the national survivability of some countries. Today, especially energy raw materials have undertaken such a mission, especially after the Industrial Revolution, industrial raw materials have been important during the two great war periods and the cold war period. One of these raw materials is chrome. In this study, the n-gram analysis of "chromium", which is one of the important raw materials after its discovery in the 18th century, was carried out and its relationship with the important political events was analyzed with n-gram analysis. Using the interface provided by Google for the N-gram analysis, an analysis covering approximately the last hundred and fifty years was carried out in March 2020. The analysis was carried out within the scope of the corpus from 1850-2018, which is registered in the "Google books" database. As the browsing language, English, German, Russian, Italian and French languages were chosen, which were widely used in this period and available in the google n-gram analysis interface. 3 was chosen as the softening factor. As a result of the analysis, it was observed that the results of the n-gram analysis showed a high frequency of use in the two major world wars, especially where the raw material was an important factor. Chromium, which has an important place in the defense industry and has an important use in the steel industry and armored material production, has seen a considerable frequency of use in these periods. It was observed that the N-gram values also gave remarkable results for periods corresponding to important military-political events after the World War II. When all the findings are evaluated together, it is concluded that it is possible to investigate the relationship of raw material supply-demand relations with political events by n-gram analysis.

Keywords: Great Depressions, World War I and II., N-gram Analysis, Chromium, Raw Material Supply-Demand

ÖZET

Madenlerin stratejik önemine binaen kriz zamanlarında hammaddelerin arz-talebi önemli bir konuma gelmiştir. Bu ilişkide hammaddenin tipi zamandan zamana değişiklik göstermiştir. Sanayi devriminden sonra, bazı hammaddeler, özellikle ağır sanayi ve savunma sanayiinde, coğrafi konumları ve sahip olunan rezervleri nedeniyle önem olmuştur. Bazı durumlarda, bu madenlerin arz güvenliği gibi konular ciddi güvenlik konularına sebep olmuştur ve hatta bazı ülkelerin milli bekalarını dahi tehdit etmiştir. Bugün özellikle enerji hammaddeleri böyle bir misyonu yüklenmektedir ki, özellikle Endüstri Devriminden sonra, endüstriyel hammaddeler iki büyük dünya savaşında ve soğuk savaş döneminde önemli olmuştur. Bu hammaddelerden biri de krom madenidir. Bu çalışmada 18. yüzyılda keşfinden sonra önemli hammaddelerden biri olan krom madenin N-gram analizi gerçekleştirilmiş ve önemli siyasi olaylarla ilişkisi irdelenmiştir. Google tarafından sağlanan arayüz yardımıyla yaklaşık son yüz elli yılın analizi gerçekleştirilmiştir. Analiz Google veri tabanında bulunan kitaplar üzerinde 1850-2018 yılları arasını içine alan dönemi kapsayacak şekilde gerçekleştirilmiştir. Analizde yumuşatma faktörü 3 olarak seçilmiş, dönemin

geçerli dillerinden olan İngilizce, Almanca, Rusça, İtalyanca ve Fransızca dillerinde analiz gerçekleştirilmiştir. Analiz sonucunda, seçilen anahtar kelimelerin iki büyük dünya savaşında kullanım sıklığının dönemin siyasi olayları ile de ilişkili olarak, özellikle de hammaddenin önemli bir faktör olduğu dönemde yükseldiği gözlenmiştir. Savunma sanayiinde önemli bir yere sahip olan ve çelik sanayiinde ve zırlı madde üretiminde önemli bir kullanıma sahip hammadde olan krom ilgili dönemlerde dikkat çekici bir kullanım sıklığına ulaştığı görülmüştür. II. Dünya Savaşı sonrasındaki önemli siyasi-askeri olaylarına karşılık gelen dönemler için de N-gram analizinin kayda değer sonuçlar verdiği gözlemlenmiştir. Tüm veriler birlikte değerlendirildiğinde, N-gram analizi ile hammadde arz-talep ilişkisinin araştırılabileceği sonucuna varılmıştır.

Anahtar Kelimeler: Büyük Buhranlar, I ve II. Dünya Savaşı, N-gram Analizi, Krom, Hammadde Arz-Talebi

1. INTRODUCTION

As a result of the development and widespread use of the digital environment, data mining has become an important phenomenon and its importance is increasing day by day. The evaluation of data in the digital world provides the opportunity to evaluate big data in a scientific framework with new techniques developed. It is thought that new research techniques will develop and continue with the increase in internet access opportunities and the inclusion of new data into the system. It is thought that new research techniques will develop and continue with the increase in internet access opportunities and the inclusion of new data into the system. N-gram analysis appears to be one of the candidate methods for evaluating data in digital environment and helping new research opportunities. The analysis method offered by Google offers the opportunity to do keyword-based research within a large book corpus in the "Google Books" database (Aleahmad et al., 2007; Bellegarda et al., 2014; Huang et al., 2012; Tuna and Ural, 2017; Vural et al., 2020a, 2020b, 2019). In this way, it allows for now, the proportional use of the frequency to cover the last 250-300 years, both numerical and graphical evaluation of the concepts, events, cases, etc. (A. . Çiftçi et al., 2020; A. Çiftçi et al., 2020a, 2020b; Ural et al., 2020a, 2020b, 2020c, 2019; Vural et al., 2020c).

Although mining history started with human history (Vural, 2006, 1998; Vural et al., 2009), chrome mine took its place in human history at the end of the 18th century and at the beginning of the 19th century. So, the history of the chrome mine does not go back long (Kogel et al., 2006). It was first obtained from the mineral crocoite in 1797 by Louis Nicolas Vauquelin. It was defined with this word referring to the word "chroma" which means color in Latin with the effect of the different colored compounds of the product obtained (Kogel et al., 2006). Stainless steel industry is one of the most important usage areas of chromium. Apart from this, concrete, chemical steel industry is also one of the important usage areas. In these sectors, besides chromium, bauxite (aluminum raw material) is one of the raw materials with important use (Benbow, 1988; Bolger, 1997; Kogel et al., 2006; Taylor, 2003). The chrome mine / element gained importance especially after the Industrial Revolution due to its indispensable place in the steel-defense industry, and as a strategic mine, it has become a raw material that the dominant states want to have or want to manipulate. It has been hypothesized that examining this strategic effect of the raw material with n-gram analysis will contribute to more detailed studies and in this study, it is aimed to perform n-gram analysis of "chromium".

Chromium being a fundamental substance for the war industry has led Turkey, who were a very important chrome exporter during the Second World War and did not go to war, experience serious political and commercial issues Turkey, which has increased its trade relations with Germany very highly since the early 1930s, by 1939, it had 37% of its total exports and 50% of its imports with Germany (Karakas, 2010, p. 451). Turkey has found itself in a very difficult situation with the start of the war in 1939 in international relations both commercially and politically due to these rates, which symbolize the becoming dependent on Germany in terms of foreign trade. During the war years, Turkey's trade with both Germany and the Allied states was choppy, as in the policy of war. Trade agreements with the Allies in early 1940 and Germany in mid-1940 (Karakas, 2010, p. 459) did not fully implement. On the one hand, allied states were pressuring Turkey not to trade with Germany, especially cereals and chromium, but they were also not willing to do something to cover the economic damage turkey would suffer. The Turkish-German Trade Agreement, which was made on 9 October 1941, is very important in many respects. With this, Turkey and Germany have determined their foreign trade for about 2 years. It is accepted that this treaty gives Germany many advantages in

relations. With this, Germany increased its share of Turkey's foreign trade, ahead of Britain. However, Germany's purpose in commercial relations was not only economic. Germany saw trade relations as a means to achieve a political goal of bringing Turkey closer to the Axis Powers (Germany, Italy, Japan) by removing it from the Allied states (England, France, USA) (Koçak, 2015, p. 656).

As for chrome trade, Turkey was stuck between allied states and Germany during the war years. The Allies were buying a limited amount of chrome from Turkey (partly because they could obtain it from their colonies) and pressuring Turkey not to sell chrome to Germany. This led to the economic loss of Turkey, which made a deal with Germany for the export of chrome in exchange for war materials. In the raw material supply and demand of the war years, there were development and fluctuate relations between Turkey and European states and the United States within the framework of the chrome mine. While the UNITED States, Britain and Germany were countries dependent on the foreign market in terms of chromium reserves, turkey's chromium trade, which was one of the leading countries in the supply of chrome raw materials of the war years, was very economically profitable for itself. Turkey sees this as an opportunity to strengthen its weak economy and wanted to take it. However, Turkey could not move very comfortably and had to follow policy according to the course of the war. Germany's intense demands and pressure from allied states have often shown itself.

Pressure from the Allies yielded results in war, and Turkey had to inform Germany that it could not export cereals and chromium until 31 March , 1943, despite the agreement of 9 October, 1941 (Ekinci, 1997, p. 198). Turkey, which also continued to meet with Allied states, especially Britain, on the trade of chromium, which is one of the indispensable raw materials of the war industry, sent 45,000 tons of chrome to Germany between March 31, 1943 and June 15, 1943. The importance of the chromium for the outcome of the war has been so great that the US has even spoken of the blowing up of bridges over the Meriç River in order to render the railways transported in operation in order to bring down Germany (Ekinci, 1997, p. 202).

2. CONCEPTUAL FRAMEWORK

2.1. N-Gram

N-gram analysis is an analysis method in which the frequency of repetition of a certain number of sub-sequences in a character sequence is investigated. While this method is increasingly widely used, it is used especially in applications such as linguistics, probability, communication theory, natural language processing and sequence analysis in computational biology, and in the areas of determining the frequency of use of malware, which is a fearful element of digital environments. Accordingly, it is used in auxiliary analysis methods in the development of applications against malware. New analyses are also used in the research of political, military and economic phenomena and new studies are entered into the literature (Çiftçi et al., 2020; Çiftçi et al., 2019; Ural et al., 2020c, 2019; Vural et al., 2020c, 2019).

N-gram analysis is named according to the length of the sub-directory to be created. If N is 1, sub-arrays are created in one character, and n-gram analysis is also called unigrams. Those that are 2 characters long are expressed in the term bigram, and those that are 3 characters long are expressed in the term trigram. Cases where the number N is 4 and above are not called under a special name, only fourgrams, fivegrams, sixgrams, etc. is called .

Google is a company that brings innovations in different fields of computing to the digital world and has launched n-gram interface application so that its users can perform n-gram statistical analysis on more than 1,500,000 digital books registered in the database. The developed interface offers the opportunity to obtain different analysis results using a wide range of fields.

In this study, Google's n-gram analysis interface was used only in the most basic form. The frequency of using chromium and related concepts in digital books in the Google database over time has been tried to be determined. With N-gram analysis, it is aimed to determine the frequency of occurrence of chromium and related concepts / raw materials in the literature, to compare the usage frequencies of these concepts with each other and to determine the changes in history. The frequency of use of a concept in the literature can be seen as an indicator of the importance attributed to that concept by those with a scientific interest. In addition, data such as when these concepts emerged, the increase and decrease in the frequency of use over

the years, the change in the ratio of the usage frequencies of the related concepts to each other are important data regarding the interest in the chrome mine / raw material and related concepts.

With the n-gram analysis, it is hoped that chromium and related raw materials will present a different perspective and contribute to more detailed studies using a different analysis method. It is important to evaluate the changes of chromium and related concepts in the literature numerically depending on time and economic, political and military events.

3. FINDINGS AND DISCUSSION

The n-gram analysis covering the period 1840-2020 for the terms nickel and steel as chromium and related concepts was created by scanning the data in English, German, Russian, Italian and French languages, taking into account the languages that were effective in the period (Figure 1). When the graphs in Figure 1 are examined, according to the n-gram analysis of the English data, an increasing frequency of use for steel is observed since the 1860s, and the increasing trend continues with some fluctuation after the relatively increase in the 1870s. A remarkable increase was observed from the 1900s to the 1920s, and a decline was observed in the late 1920s. In the graph, a remarkable increase is observed again after the 1930s. Especially in the period that coincides with the end of the Second World War, the decline shows itself. The frequency of use of chrome and nickel concepts for the aforementioned periods has not been observed to be very remarkable. The n-gram graph created in German was observed to be much more striking. The n-gram analysis for chromium and nickel, which are the raw materials of steel and steel, shows a meaningful output during both World War I and World War II. Considering the role of Germany in both great wars, the graph obtained shows a much more meaningful usage frequency confirms the hypothesis of the study. In the German literature, the frequency of use of chromium and related concepts, which is the subject of our study, draws attention during both war periods, with a higher rate in the Second World War, in proportion to Germany's important place in both wars.

In the graphs, it is seen that in the 1950-1953 Korean War, the Vietnam War in the 1960s, the famous Oil Crisis in 1973, the fall of the Berlin Wall in 1989 and the collapse of the Eastern Bloc that resulted in the dissolution of the USSR in 1991 there is a significant increases in all of the incoming periods.

It is clearly seen that n-gram analyzes of Russian, Italian and French sources have a similar frequency of use trend (Figure 1).

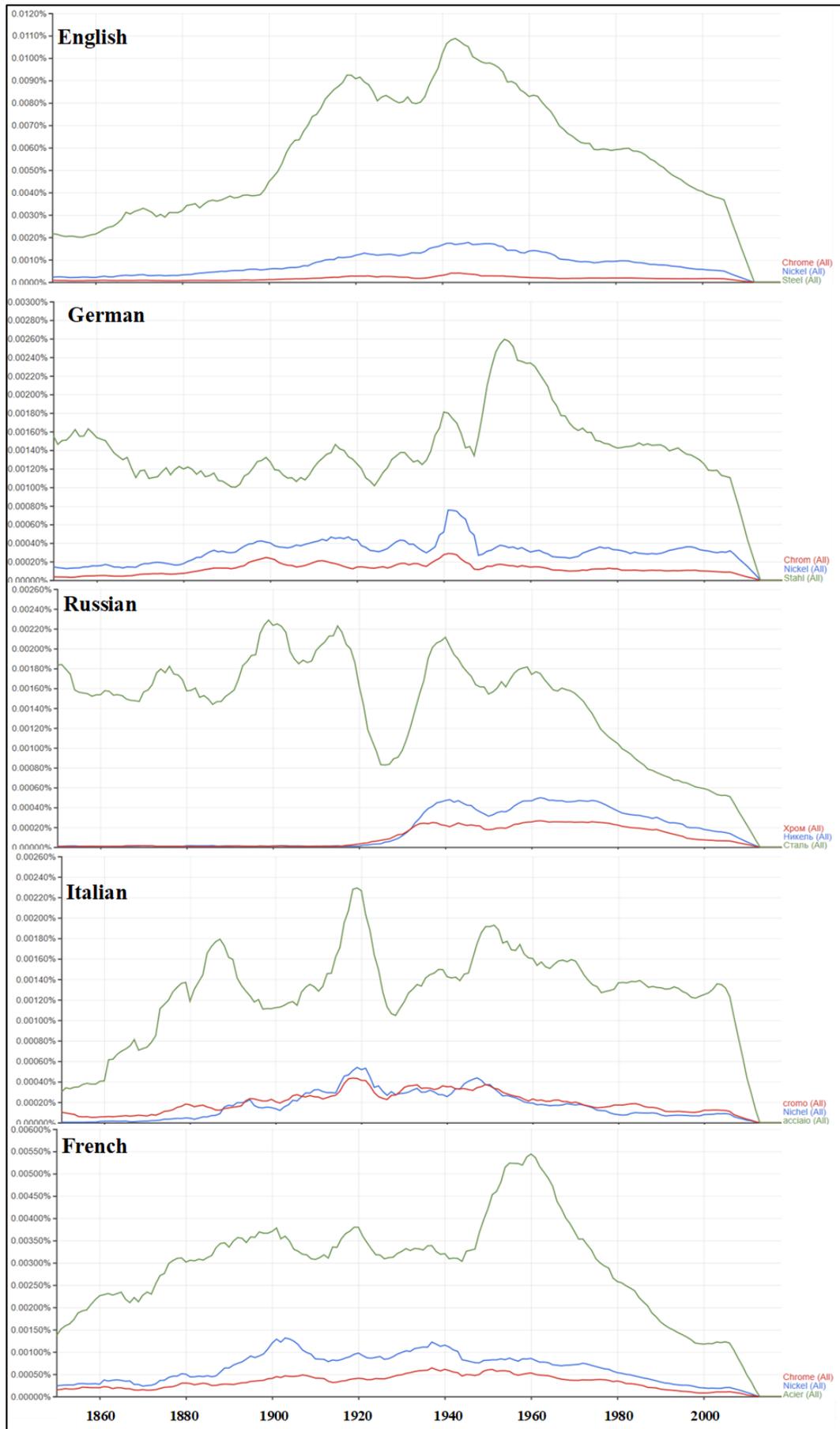


Figure 1. Graph of N-gram analysis for chromium and related terms nickel and steel

4. CONCLUSIONS

In the world political history, precious metals and other raw materials have often led to conflicts between states. Measuring the change of raw material supply and demand relationship over time and events gives interesting results for researchers. The strategic importance of some mines-metals has increased especially after the Industrial Revolution. One of them is steel. Steel, chromium and nickel are among the most basic materials needed in industry. The indirect contribution of these mines, which are of great importance in the size of industrial production, to the development of countries is also clear. As it is known, chromium provides hardening of steel and increases its resistance against impacts. At the same time, the resistance of the steel against oxidation and corrosion is provided by chromium.

In this study, n-gram analysis was carried out to cover a 200-year period between the years 1820-2020, considering chromium and related raw materials. While doing this, it has been kept in mind that an important pillar of development is the steel industry and that the most important raw material source of steel is chromium. According to the results of the n-gram analysis made by taking into account the languages that are effective in the world for the relevant periods, it has been determined that the frequency of use of the key concepts analyzed especially in war-defense priority periods in the world history has increased. Especially in the two great World Wars and the following periods, a significant increase in the frequency of use of the concept was detected in the periods corresponding to the Korean and Vietnam Wars, where the active participation of the USA, which has a dominant role in the world political and economic history. Therefore, it has been concluded that the use of keywords used in the literature in the n-gram analysis, in which the frequency of use of chromium and nickel, which are the main raw materials of steel and steel, which are related to industry, is analyzed in the literature can be examined and that this relationship is linear. Examining the two great war periods in the 20th century from this point of view gives an adequate idea. As the most concrete example of the relationship between the military and political events of chrome and other raw materials, what Turkey lived in the Second World War can be shown (Fig. 2 and 3).

Turkey (as state) and chrome keywords, and Turkey, chrome and aluminum (another steel raw material) when considered together (Fig. 2a and b), is clearly evident as reflected in the graphs of the Second World War. In these years, both words have a remarkable usage frequency in the literature. Since Adolf Hitler was the main actor of the World War II, a new n-gram analysis including him is also given in Figure 3. When Figure 3 is examined, similarly, the keywords in the 1940s show a striking parallelism. Although Turkey did not join the war, it remained at a crossroads in its relations with countries in the demand for raw materials and of their struggles only because that it supplied of raw material and chrome and so it has experienced serious tensions. The debates in the country and the world public opinion were reflected in the literature, and this showed itself in the graphs in the n-gram analysis (Fig. 2 and 3). It is seen a remarkable parallelism between keywords Turkey (Türkiye) and chrome, for especially the period covering the years of World War II (Fig. 2a), also between keywords Turkey (Türkiye), aluminum and chrome (Fig. 2b). It is seen from the graph (Fig. 3) that the selected keywords (Turkey, chrome and Adolf Hitler) have a meaningful usage frequency in the years of the second world war.

It was concluded that the hypothesis that the examination of chromium and nickel and related keywords, which are an important raw material of the steel industry, by n-gram analysis will contribute to the conduct of more detailed studies has been confirmed.

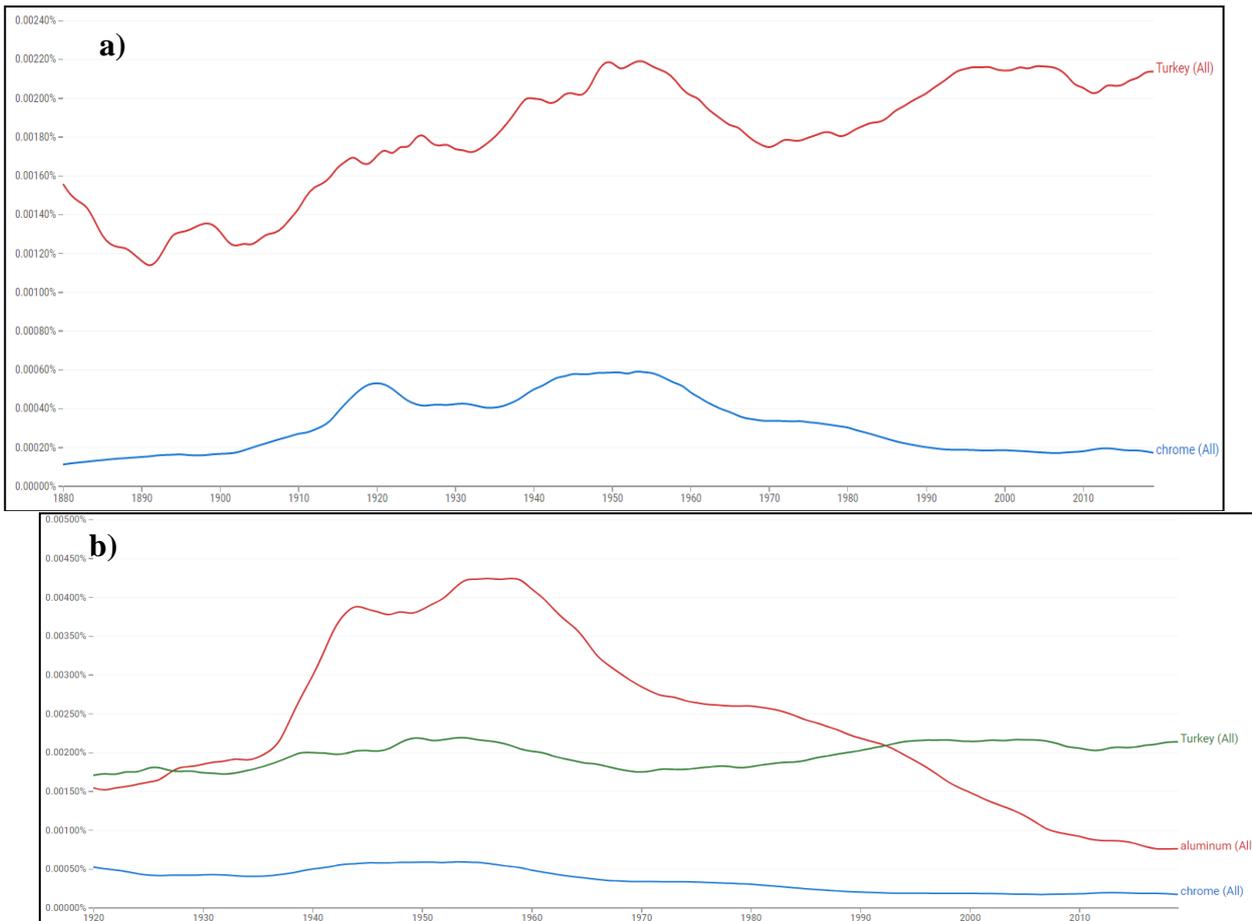


Figure 2. a) N-gram analysis of the Turkey (Türkiye) and chrome keywords. b) N-gram analysis of the Turkey (Türkiye) chrome and aluminum keywords.

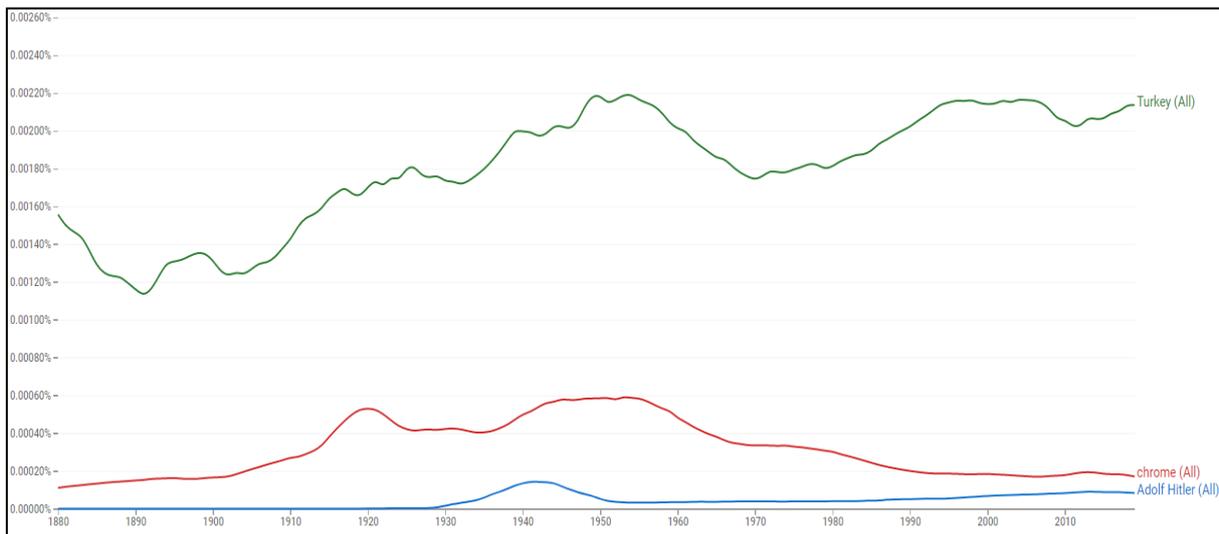


Figure 3. Adolf Hitler, the most important actor of the World War II, was added to the parameters in Figure 2a to analyze the relationship of these three concepts with n-grams.

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