Bankers and Andean minerals in the German global strategy, 1901-1914

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Abstract

This article examines the development of extractive activities in Chile, Peru and Bolivia, and the link with a network of bankers, diplomats, entrepreneurs and politicians who allowed the supply of strategic materials (tin, nitrates and cooper) to Germany during the years before the outbreak of the First World War. The network operation and the definition of a German diplomatic strategy facilitated the supply of Southern Andean mining companies, across to merchant houses, private bankers and joint stock banks as intermediaries and German industrialists who transform of these strategic materials that reinforced the German growth, the innovation process, economic development, merchant fleet and military industry.

Key Words: Banking, Diplomacy, Strategic materials, Germany

JEL Classification: N20, N26, N46, N56

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1. Introduction

The extractive spaces of southern Andean region became during the nineteenth century, in an attractive location for the migration of workers, entrepreneurs, bankers and miners. The interest of Chilean, British and Germans entrepreneurs and bankers allowed them to build their fortunes with the general economic boom, mining, *casas de rescate*, railways and maritime transport business, foreign trade and its financing (Barros, 1970, pp. 570-3; Cademartori, 1968, p. 59). After the War of Pacific (1879-1883) between Chile, Peru and Bolivia, and border transformation, the region continued its supply of minerals under a new territorial scheme where Bolivia renounced definitively the coast, but did not affect mining extraction, the family business, the shipment of minerals, foreign investment and banking business.

As a result, the Valparaiso port became a regional distribution centre for goods which arriving mainly in British and German ships (Fifer, 1964, p. 510). This port and the others in the region were linked to mining centres through a railway network which integrated extractive spaces of Chile, Peru and Bolivia, which in 1890 had approximately 2800 kilometres to almost 12,300 kilometres in 1914 (Albion, 1951, p. 373; Barclay, 1917, p. 244; Gómez, 2006, p. 24; Sutter & Sunkel, 1982, p. 142; Whitehead, 1972, p. 54).

The progress of trade, mining and transport in the region, joined with the diplomatic strategy of the central economies (Britain, Germany, United States and France) that were based on national interests, territorial rivalry and productive capacity (Granados, 2010, pp. 52-53). This prompted these economies come to the regions that could satisfy their demand for strategic materials due to an accelerated industrial processing. There were four powers that the nineteenth century had built, and to these financing schemes, banking systems and stock markets were important (Fohlin, 2007, pp. 21-8; Lewis, 1978). However, the banking

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2 The compensation negotiated by Felix Aramayo, entrepreneur and Bolivian diplomat, was two millions of pounds, the construction of the Arica-La Paz which came into operation in 1913, as well as ensuring the transit trade through Chile and facilities in the ports of Arica and Antofagasta (Contreras, 2000, p. 206; Couturier, 1986, p. 46; Crespo, 1981, pp. 158-166; Granados, 2014, p. 48; Klein, 1969). This treaty was reduced to three hundred thousand pounds. See (Abecia, 1986, pp. 342-3)
and diplomatic integration as proposed by Germany in times of Kaiserreich, made the difference.

After the departure of Chancellor Otto von Bismarck in 1890, Kaiser Wilhelm II wanted to develop a Germany that is equalized with the strategies that had done great to the other European empires. For this, he reorganized his political, diplomatic and military scheme, where the supply of strategic materials from regions that complement the mineral wealth of the Rhine valley and the Ruhr basin, to start the twentieth century with an economic and political structure precise to achieve his world power project. Wilhelm II argued that the new century would be dominated by science and technology and not as the nineteenth century, dominated by the philosophy (König W., 2007, p. 236).

This German purpose, joined with two political events during the analysis period (1901-1914), who transformed the scenario of banking and international business. First, the culmination of the Victorian era in Britain (1837-1901), who achieved to build an international expansion of banks, firms, investors, capital and knowledge, and second, the presidency of the United States of Theodore Roosevelt, who from arrival was interested in strengthening its economic and political influence in Latin America. This became part of an economic and industrial expansion that accelerated the global growth by focusing on two processes: the first to the central economies with their export structures and strengthening the domestic market, and second, the commodity export boom of the periphery (Granados, 2010, pp. 54-55).

A growth rate was reached of 3.1 per cent for the period 1899-1907 and 2.6 per cent for the period 1907 to 1913, while imports grew 3.8 per cent and 4.5 per cent respectively (Solomou, 1990, p. 58). In the first process, US exports rose 7.9 per cent and real economic growth was 3.8 per cent, Britain 3.4 per cent and 1.3 per cent respectively, Germany 4.9 per cent and 2.9 per cent and France 3.4 per cent and 1.9 per cent for the period 1892-1912 (Staley, 1944, p. 127). The rate of long-term growth of industrial output (1880-1910) was 3.65 per cent on average, as well as a supply of raw materials from the periphery markets 37 per cent by 1913 (Fontana, 2006, p. 230; Lewis, 1978, p. 167).
In the second process, the total exports for 1913 in Bolivia were concentrated in tin with 72.3 per cent, Chile in nitrates with 71.3 per cent and Peru in copper with 22 per cent (Mitchell, 1983, p. 157). In the same year, Bolivia sent 80.8 per cent of her exports to Britain, followed by 8.5 per cent to Germany. Chile had a more balanced distribution with 38.9 per cent to Britain, 21.5 per cent to Germany, 21.3 per cent to the United States and 6.2 per cent to France. Peru had a distribution of his exports 37.2 per cent to Britain, 33.2 per cent to United States, 6.7 per cent to Germany and 3.5 per cent to France (Bulmer-Thomas, 1994, pp. 74, 94-95; Klaren, 1986, pp. 248-251). Thus, that export duties went from 24.9 per cent of ordinary fiscal revenue in 1885 to 39.1 per cent in 1915, and the total customs duties of 75.9 per cent (Cademartori, 1968, p. 66; Sutter & Sunkel, 1982, p. 140).

For 1895, the business of nitrate was led by Chileans with 23 per cent of production, 17 per cent of Germans and British managed the 60 per cent of production, beginning with alliance between the British government and John North, which expanded the monopoly of water supply in Iquique and Peruvian property certificates issued in 1876, that the Chilean government endorsed and served as collateral for financing in Chile and Britain (Collier & Sater, 2004, p. 165; Monteón, 2003, pp. 74-76; O'Brien, 1982, pp. 67-69; Rippy, 1948, pp. 458-460; Sutter & Sunkel, 1982, pp. 127-136). However, in 1912 the German industry had already developed synthetic nitrates, reducing the use of natural nitrates and affecting the volume of exports from Chile starting from this year.

The anti-corrosive properties of the tin allowed the export progress in Bolivia, favoured by the increase that happened in the price of $ 615 in the early twentieth century to $ 881 on average for the five years from 1910 to 1914 (Abadie-Aicardi, 1966, p. 24; Ruiz, 1956, pp. 50-51). Also, for the discovery of new mineral deposits that increased her share in the world market from 10.7 per cent in 1900 to 19.3 per cent in 1913 (Thoburn, 2014, p. 226). Germany required of the tin for military and naval industry and to supply her refining industry. By 1907 it exported 182,400 tonnes and by 1913, 460,800 tons of refined tin (Molodowsky, 1927, pp. 669-72).
In Peru, the new mining code of 1901 allowed the revival of copper mining, and the advance of US investment. The Peruvian Mining Project of James Haggin and JP Morgan established the acquisition and activation of the mines that were closed since the nineteenth century and the development of a stock company with an authorized capital of USD 10 million. The company was formed with contributions from Haggin by 34 per cent, 22 per cent Iwomully, Frick Coke (a subsidiary of US Steel), Mills, Hearst and Morgan 11 per cent each, the latter had a personal involvement and the other half on behalf of JP Morgan & Co. (TMLM, ARC 110, p.59, p.61). The Cerro de Pasco Investment Company facilitated the launch of Peruvian mining and participated in the activation of the real prices that reached a maximum of 82 pounds per metric ton by the end of 1909 at the London Metal Exchange (Felgran, 1982, pp. 35-36; Schmitz, 1986, p. 409).

The US investment was organized under vertical structures as Braden Cooper & Co., American Smelting & Refining (Guggenheim Brothers), Anaconda Copper, US Smelting, Refining & Mining Co., and Phelps Dodge. This allowed them to accumulate sufficient financial capacity to explore and exploit the South American region, which had a cheap labour supply.

This political and economic context that mentioned above, allows us to integrate the proposed of Chandler (1992, pp. 83-6) and Lazonick (2003, pp. 33-5, 43), regarding how a business organization is related to a network of firms participating in the transformation of institutional, organizational and industrial conditions, because innovation is analysed from the perspective of organizational integration, linking a large number of agents and firms to establish the result of innovation, the resources optimization and combining them with elements of organizational capabilities that allow companies to be more than the sum of its parts.

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3 This is a Chandler's adaptation of Kaplan's work on non-ferrous metals industry in the United States for 1909. See (Chandler Jr., 1962, pp. 5, 327).
4 The Guggenheim Brothers took this facility that gave the Peruvian and Chilean market, although the latter was in the boom of nitrates (O'Brien, 1989, pp. 129-32), but it would be the beginning of the copper expansion amid falling exports of nitrates given by the expansion of synthetic nitrates that Guggenheim also wanted to take the end of First World War, because the German production of synthetic nitrates decreased with end of the war (Glaser-Schmidt, 1995, pp. 177-9).
Likewise, Amatori and Colli (2011, p. 13) established that companies organize complex relational schemas to develop their business, and sometimes as mentioned Zeitlin (2003, pp. 68, 71), used strategies such as linking in government affairs, integrating forward and backward, vertical integration, cartels, alliances and pressure groups seeking control of the market. These strategies are part of the historical construction of markets but not necessarily, the success of enterprises.

This paper investigates these issues from the evolution of business and merchant schemas using a mathematical model of network analysis and complex systems, from the information obtained in private archival sources. The contribution, then, is to analyse from a dynamic perspective the global business network that developed in the trade of strategic materials and answer the question: if the southern Andean countries joined a global business network where bankers of central economies, diplomats, entrepreneurs and traders developed a trade of strategic materials beginning with the industrial expansion in Germany?

The goal, then, is to analyse from mineral extraction in Bolivia, Chile and Peru, the construction of a global network of international business with a central and dynamic hub in the international financial system. Where, the German diplomatic strategy and the interaction of the merchant and banking houses facilitated the supply of minerals for that German entrepreneurs transform and strengthen the innovation and industrial development, and also, the advancement of extractive spaces, the business development and deepening of business-government relationship.

This document is divided into five sections, besides this introduction. A second presents the characteristics of the global network model. A third examines the industrial and banking network starting from the definition of raw materials diplomacy by the German government to advance its global project. A fourth, discusses the creation of a local network in the extractive spaces from the interaction of banks, entrepreneurs and governments, and evolves to a global network among the Andean countries, the international financial system and Germany. The final section provides a conclusion.
2. Network Representation

Mathematically represents a global network (WG), from an approach based on graph theory to analyse the complex structure of the political, financial and business relations that developed between extractive areas of the Andean region, the international financial system and Germany. A network is defined as a finite set of agents (nodes or vertices) and links (sides or edges). The links can be directional, symmetrical, multi-directional and asymmetrical, some with a pattern of reciprocity, formality and informality. In this case, the links represent the financial, business or political relationships between agents represented by joint stock banks, merchant banks, private banks, local banks, mining companies, merchant houses, refiners, industrial companies and government institutions.

The global network (WG) that arises here, is an interconnection network, namely: a German network (D), a network of extractive spaces of Bolivia, Peru and Chile (A) and a network of international financial system (F). Neither of this networks is a formal network, i.e., there is no organizational hierarchy but is more like a community of practice or a network of casual communications between individuals, institutions and organizations, where progress is made in the performance and the evolution (Huberman & Hogg, 1995, pp. 77-78; König & Battiston, 2009, p. 26). In this case the evolution of business in extractive areas, economic growth and technological progress in Germany.

For the construction of the global network, start with a simple network that is set as a graph (G) with (n) nodes and (m) edges, consisting of a set of points of intersection \( V(G) = \{v_1, v_2, ..., v_n \} \) and a set of edges \( E(G) = \{e_1, e_2, ..., e_m \} \), where each side has two nodes called endpoints, which may be identical, which is mathematically represented by a proximity matrix. The element of proximity matrix \( (a_{ij}) \) indicates that the link between the nodes \((i)\) and \((j)\) (De Masi, 2009, p. 243). Where \((a_{ij}=1)\), if the link is effective, otherwise will be \((a_{ij}=0)\). That is, the degree of a node \((i)\) is the number of links coming out of it and is calculated by:
Here, is integrated the concept of centrality of the agent or node. The centrality does not occur within any of the networks that make up the interface, even though the international financial system was the core of the global network \(WG\), which has an important size and a number of links \(k_i\).

The importance of a node depends on the importance of its neighbours, defined with the concept of eigenvector centrality. It is assumed that the importance of the node \(i\) is determined by \(x_i\), and the eigenvector centrality of node \(i\) is proportional to the sum of the centrality of the eigenvectors of all nodes that are connected to \(i\).

\[
x_i = \frac{1}{\lambda} \sum_{j \in N_i} x_j = \frac{1}{\lambda} \sum_{j=1}^{n} a_{ij}x_j
\]

Where, \((N_i)\) is the set of nodes that are connected to node \(i\), \((n)\) is the total number of nodes and \((\lambda)\) is a constant (König & Battiston, 2009, p. 34). This establishes that no exist a centrality at interconnection network, but meets the assortativity, i.e., the similarity between nodes is defined by:

\[
k_{nn}(i) = \frac{1}{k_i} \sum_{j \in v(i)} k_j
\]

Where, nodes with high degree are connected to nodes with high degree inasmuch as joint stock banks, merchant banks and private banks have an extensive interaction, while recognizing that other agents that are not part of the financial system can connect or join the network.

The distance \(d_{ij}\) between nodes \((i, j)\) is the smallest number of links to go from \((i)\) to \((j)\). Therefore, the neighbours of node \((i)\) are all the nodes \((j)\) which is connected to this node through a single link \((d_{ij} = 1)\). Using proximity matrix, this can be written as:
Thus \((P_{ij})\) is the connection path between the node \((i)\) and the node \((j)\). As from the distance between the nodes \((i, j)\), is established the average length of the path \((\zeta)\). This is important for agents that represented banks, because these agents benefit from the knowledge of the other agents (banks) and when the distance between agents is smaller, the exchange of knowledge is most intensive and therefore the business development (De Masi, 2009, p. 243; König & Battiston, 2009, p. 32). The average length of the path \((\zeta)\) is set to:

\[
\zeta = \frac{1}{\frac{1}{2}n(n-1)} \sum_{i \neq j} d_{ij}
\]

Finally, each network has a greater or lesser rate of clustering coefficient \((cc1(i))\) which is the measure of the density of connections around a node, and is defined as:

\[
cc1(i) = \frac{2}{k_i(k_i - 1)} \sum_{j \neq i} a_{ij}a_{ih}a_{jh}
\]

Therefore, the clustering coefficient allows calculate the proportions of the nearest neighbours of a node that are linked between them. This feature is essential in networks that make up the global network. In the case of the international financial system (F), the clustering coefficient is given in each of the financial markets in which they operate, but also, the agents were integrated in the business development at the region. That is, knowledge of business in extractive spaces, integrates the banks and allows them not only to develop financing activities and the mercantile business, but also reduce the risks or make the decision to build a network of correspondent banks in the region, or directly to participate in the network of local financial systems with offices in the cities of extractive spaces.

The networks are built from a strategic formation, where the choice of linking or not is determined by individual incentives and potential benefits versus the costs arising from the creation or removal of a link. This sequence allows the network to reach equilibrium, since
the results of the agents are interdependent and this interdependence is defined by the
structure of the network, leading to the notion of pairwise stability (König & Battiston,
2009, p. 52).

This notion holds if and only if the removal of any link does not increase the utility of
any agent and if adding a link between two agents does not affect the usefulness of any of
the two agents, if increases the utility of one should reduce to the other (Jackson &
Wolinsky, 1996, pp. 66-68). If each agent can unilaterally set or remove a connection with
another agent is nearer to a Nash equilibrium that is characterized by a set of strategies
where each strategy is the best answer for the others (Gibbons, 1992, pp. 8-9).

From this, the agents receive information from other agents to which they are connected,
and through these links, also receives information from those agents that are connected
54). The utility ($u_i(G)$), that receive the agent ($i$) of network ($G$) with ($n$) agents is then:

$$u_i(G) = \sum_{j=1}^{n} \delta^{d_{ij}} - \sum_{j \in N_i} c$$

Thus ($d_{ij}$) is the number of links in the shortest path between the agent ($i$) and agent ($j$).
($d_{ij} = \infty$) if no exist a path between ($i$) and ($j$). ($0 < \delta < 1$) is a parameter that takes into account
the reduction of the utility when the path between the agent ($i$) and agent ($j$) increases. ($N_i$)
is a set of nodes in the neighbourhood of the agent ($i$). Probably one of the networks that
make up the global network, is closer to a network with multiple connections, and may be
scattered, locally dense and presents a heterogeneous degree distributions (Powell, White,
Koput, & Owen-Smith, 2005).

From these characteristics, interconnection of networks is defined as a graph structure
that facilitates convergence, connectedness and continuity. In this case the business
development from the South American extractive spaces to Germany. However, interconnection networks, must achieve some desirable properties as a homogeneous
degree, a reduced diameter, symmetry, low congestion, high connectivity, high fault
tolerance and efficient routing (Zhou, Du, & Chen, 2006, p. 698). For this case were used Cayley graphs, which have fixed degrees and can serve as an interconnection network, as it can have a larger number of nodes for a given diameter (Fu & Chau, 1998, p. 1254). This makes it easier to visualize and reduce the centrality and asymmetry, as banks in the international financial system didn't defined as a dominant structure or dominated by a single entity, but built relationships peer, despite being competitors in several opportunities. It also differs from the schemes proposed by some researchers when they analyse a historical problem with traditional network analysis, which fail to overcome the asymmetry and centrality when it really is not presented.

This allows properly illustrate the interconnection of the banking networks with the networks of knowledge, as a structure that tends toward efficiency as properly achieving business development, the integration of knowledge, information and industrial development in Germany. The topology of the network, namely its diameter, is crucial for network interconnection, since it determines the network performance and allows you to add an analytic factor to historical analysis. This family of interconnection networks $W^m_n$ with fixed degree, is the network more convenient to explain the global network because it is a representation of finite groups and a highly symmetrical graph (Gross & Yellen, 2006, p. 623).

To develop an interconnection networks from a Cayley graph, initially defines a star graph $(S_n)$ bearing in mind the above characteristics, as a graph of its nodes are $(n!)$ with permutations of $\{1, ..., n\}$ and where the nodes are connected by edges whenever two permutations are connected by the exchange. Thus, $S_n = (V, E)$ con $|V| = n!$, and $V=\{s_1, s_2, ..., s_n\}$ is the permutation of $(n)$ and $E=\{(u, v) \mid u, v \in V \land v=SWAP_j(u) \text{ for } j, 1 < j \leq n\}$. These graphs are of degree $(n-1)$ and have a diameter of graph $[3(n-1)/2]$ (Rajasekaran & Wei, 1997, p. 226). A generalization of $(S_{n,k})$ is regularly of degree $(n-1)$, a size $\frac{n!}{(n-k)!}$. A diameter $d(S_{n,k}) = (2k-1)$ for $k \leq [n/2]$ and $[(n-1)/2]+k$ for $k \geq [n/2]+1$, which satisfies the symmetry of nodes (Chiang & Chen, 1995, pp. 259-260). Graphically, $(S_{3,2})$ defined as:
This means that each node and link in this kind of graphs are transitive, that is, that when an agent is related to another and this one with other, then the first agent is associated with the third (Hsu & Lin, 2009, pp. 53-54; Lakshmivarahan, Jung-Sing, & Dhall, 1993, p. 403). From this, can establish a connection between the star graphs of order 4 (See graph 4a) and serve as a basis for defining the global network (WG), namely, a Cayley graph $WG^{m}_n$ with fixed degree $(2m-1)$ and isomorphic. In $WG^{m}_n$ the links are bidirectional and established as: $(m=2) \ y \ (n=3), \ i.e. \ WG^{2}_3$, where each group of nodes (star chart) can be connected with three other groups through two links each. The links are determined by a symmetric function $(f_i)$, called link $(f_i)$. A cycle in $WG^{m}_n$ only has links $(f_i)$ called cycle $(f_i)$, where each cycle contains different nodes, that is, the dynamics of the system occurs because the nodes maintain symmetry but may be different in each cycle, in this case, a new business, the agents usually participate in different way to the previous.

3. German Network: Diplomacy and Commodities

Before analysing the German network, where the government's diplomatic strategy was integrated with industry, banks and merchant houses to develop their global project (see Figure 5), it is necessary to specify some elements of dynamics of politics and economics of Germany.

In 1890, Bismarck who had built the leadership of the German Empire, the guarantor of European diplomatic balance and the financing of German industry, leaving his office
because of the strong criticism of his domestic policy and his differences with the Kaiser (Mommsen, 1973, p. 7). Until then, Germany had already achieved international influence through her industries and the construction of the necessary banking connections that enabled her to acquire new areas of influence (Feis, 1930, pp. 160-1). Despite this, the German Hanseatic circles, especially the mercantile elites of Hamburg, Bremen and Lübeck had pressed to initiate colonization beyond economic diplomacy.

Wilhelm II (g1) deepened the patriotism of empire, Reichpublizistik, and the Germanness, Deutchum, reactivated in 1897 with the Weltpolitik under the internal pressure of agrarian elites about the political consequences that industrialization was generating to them, a reaction to the rapid growth and the change (Lewis, 1955, pp. 170-175). There was also pressure from other nationalist groups like the Pan-Germanic League, Alndeutscher Verband, led by Alfred Hugenberg, the Colonial Society, the Navy League, Flottenverein, who considered sterile the German international expansion and the same monopolistic structure of German capitalism (Clarck, 2007, pp. 580-2; Kaiser, 1983, p. 443; Manz, 2012, pp. 200-202; Mommsen, 1969, p. 109). This international expansion was supported by elite of scientists, economists, intellectuals and academics, under the scheme of the sciences of state, Staatswissenschaften, which strengthened the German imperial project (Grimmer-Solem, 2007, p. 317).

Wilhelm II also accelerated his industrial project by the situations that lived in Europe and the periphery. First the Fashoda crisis to the Franco-British Entente, where several French politicians sought ways to consolidate an alliance with Germany to balance her position with Britain (Cockfield, 1983, pp. 265-6). Second, the Russo-Japanese War, the North African crisis, the Spanish-American War, the crisis in Bosnia, the presence of a new power in the Mediterranean, the Franco-Russian alliance, and the distance it took Russia from Germany, which approached to Germany to the Ottoman Empire looking for fertile land (Andrew, 1914, p. 147; Lerman, 1997, p. 221; Platt, 1984, pp. 65-67; Rowe, 1999, pp. 201-204). For this, he focused on business and integrated active with industry, especially with Friedrich Alfred Krupp, in spite of a critical and vigilant Reichstag (Epkenhans, 2010,
p. 106), and combined it with his diplomatic strategy, first with diplomacy of alliances and later with the diplomacy of the war.

Table 1. Industrial Variables, 1880-1913

<table>
<thead>
<tr>
<th>Variable</th>
<th>Year</th>
<th>France</th>
<th>Germany</th>
<th>Britain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing Production</td>
<td>1880</td>
<td>42.2</td>
<td>45.9</td>
<td>123.8</td>
</tr>
<tr>
<td></td>
<td>1900</td>
<td>36.8</td>
<td>71.4</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>1913</td>
<td>32.9</td>
<td>80.0</td>
<td>73.5</td>
</tr>
<tr>
<td>Production of Iron/Steel</td>
<td>1880</td>
<td>34.0</td>
<td>48.0</td>
<td>156.0</td>
</tr>
<tr>
<td></td>
<td>1900</td>
<td>30.0</td>
<td>126.0</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>1913</td>
<td>92.0</td>
<td>352.0</td>
<td>154.0</td>
</tr>
<tr>
<td>Energy Consumption</td>
<td>1880</td>
<td>16.9</td>
<td>27.5</td>
<td>73.1</td>
</tr>
<tr>
<td></td>
<td>1900</td>
<td>28.0</td>
<td>65.5</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>1913</td>
<td>36.6</td>
<td>109.4</td>
<td>114.0</td>
</tr>
<tr>
<td>Industrial potential</td>
<td>1880</td>
<td>25.1</td>
<td>27.4</td>
<td>73.3</td>
</tr>
<tr>
<td></td>
<td>1900</td>
<td>36.8</td>
<td>71.2</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>1913</td>
<td>57.3</td>
<td>137.7</td>
<td>127.2</td>
</tr>
</tbody>
</table>

*Note: Britain 1900=100

German economic growth, based on industrial progress, was higher than other countries in Europe. It was integrated with the manufacturing development and the steady supply of raw materials, energy resources and strategic materials, which attended industrial demand through local exploitation and import from different regions, especially the Southern Andes. This resulted in a growth rate of industrial potential of Germany during the period 1880-1913 from 12.2 per cent annual average, while France and Britain 3.9 per cent and 2.2 per cent respectively (see Table 1). Using the Kuznets methodology, the total German GDP grew by an average of 35.6 per cent per decade, while Britain and France grew 25.0 per cent and 18.6 per cent respectively.⁵

⁵ Kuznets (1959, pp. 42-43) used intervals for decades in a long term, he established as the first interval 1860-9 to 1904-13.
This economic and political expansion generated two situations. First, a competition with British in the industry, trade and naval structure, the latter was vital to the commercial expansion, which integrated with the capital of the new banks was the key element of the German advance that maintained a constant interaction between capital and industry. Second, the rivalry with France focused on the risk of Mitteleuropa under German direction, which would cause difficulties in the sustainability of the French nation, bearing in mind that the German people was seen as a demographic and industrial power that required an expansionist foreign policy (Naumann, 1916, pp. 269-275; Rider, 1996, p. 43).

The Kaiser's decision to address the future into the sea, that reconciled him with the most radical elites, established the need to demand a greater volume of strategic materials, which were part of a force structure to compete with the British navy that had been built gradually since the proclamation of the Navigation Act of 1651 and its complementary acts. Wilhelm II wanted to imitate this, with the creation of the naval laws, Flottengesetze, during the fourteen years after the first law of 1898, which expanded the capacity of the Reichsmarine in more than 30 warships and would pass from the sixth to second position of naval fleets during this period. This naval expansion coincided with the Krupp's expansion, which was seen internationally as a German government policy, a fact which is confirmed by the increase in the group's employees from 24,000 in 1890 to 81,000 a few months before the war (James, 2012, pp. 130, 303).

From this diplomatic strategy, the development of German naval and military industry was leading companies as Thyssen (g5), Krupp (g6), and to a lesser extent Gelsenkirchener Bergwerks AG (g4), whom integrated to the Kaiser's political plan to build the network starting from three structures (see Figure 2).

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6 The German fleet before the war consisted of thirteen frigates, sixteen battleships and five cruisers, with better performance than the British (Kennedy, 1976, pp. 208-29; Zorgbibe, 1994, p. 101).
Figure 2. German Network (G)
*Source:* Development by author. See (Gross & Yellen, 2006; Hsu & Lin, 2009; Jackson, 2008)

First, with smelters: Zinnwerke Wilhelmsburg GmbH (g7) and Norddeutsche Affinerie (g9) in Hamburg, Deutsche Gold und Silber-Scheideanstalt DEGUSSA (g8) in Frankfurt. Second, with nonferrous metals traders: Aron Hirsch & Sohn (g10), Metallgesellschaft AG (g11), and Beer Sondheimer & Co (g12), who with an international network of agents, correspondents, subsidiaries and intermediaries that supply the industrial structure and were linked directly with mining companies in the region, example of this was Henry Sloman (Becker, 1998, pp. 67-71). Third, and especially Krupp, with some executives as Karl Helfferich and Gustav Hartmann of Deutsche Bank and Dresdner Bank respectively who were part of its advisory committees and supervisory (James, 2012, pp. 126-127). The German industrialists created a structure of cooperative managerial capitalism as argued by Chandler (1990, pp. 426-7) that confirmed Alfred Hugenberg in the early days of the war: “is the definitive end of the era of economic individualism”.

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7 Cited in (Epkenhans, 1988, p. 82)
This industrial structure remained Bismarck's decision to integrate technical schools to industrial processes which facilitated the improvement in competitiveness and optimization of production factors, compared to the difficulties encountered in Britain and France since the crisis 1873, both yield of the industry like a sustainable of the innovation process. From this, the network evolved and transformed with the private banks that provided resources in the short and long term for industries (Birnie, 1949, p. 120), as Mendelssohn & Co (s₁), Bleichröder (s₂), Speyer Brothers & Co (s₃), M.M. Warburg & Co (s₄), and N.M. Rothschild & Sons (s₅) that since 1902, with the death of Wilhelm Rothschild, the operation of the Frankfurt office was closed, relocated to London and gave the businesses of this office to Diskonto Gesellschaft (see Figure 4b).

Also, the joint stock banks Dresdner Bank (s₇), Deutsche Bank (s₈), Diskonto-Gesellschaft (s₉), Commerz Bank (s₁₀), Berliner Handelsgesellschaft (s₁₂), Schaffhausensche Bankverein (s₁₄), Darmstädter Bank (s₁₇), that they were strengthened with the merger of local intermediaries (Feis, 1930, pp. 62-3). Some German banks created specialized agencies to the region, neglecting what Bismarck asked, some years ago, to private bankers: invest in the advancement and industrial progress of Germany, and not in other countries (Feis, 1930, p. 69; Stern, 1977, pp. 307-308).

The funding of German industry sought meet the requirements of the diplomatic strategy and achieved to lead the strengthening of economic growth, technological progress and competitiveness, which added to favourable institutional conditions for industrialization, infrastructure development (Chandler Jr., 1990, p. 413; Fohlin, 2007, p. 21), and capital export, especially to regions which supplied their demand for industrial minerals. The global long-term investments of Germany for 1914 amounted to 23.5 billion marks, with Latin America, the most important region with 16.2 per cent of this value (Feis, 1930, p. 74). The German global project was focused on a great business model, modern large-scale enterprises, which developed the organizational mechanisms to coordinate transactions between firms, unlike what happened in France and Britain (Kinghorn & Nye, 1996, p. 110).
Despite this, the German fiscal policy did not advance in the same way that diplomacy and industry. The Germany's inability to budgeting and generate public resources that she needed to continue expanding defence and military industry, occasioned the dissolution of the Reichstag on three occasions ($g_3$) and increased the spending between 1910 and 1914, to strengthen of land forces from 203 to 442 million of dollars, which accounted for 4.6 per cent of national income (Clarck, 2007, p. 603; Ferguson, 1994, pp. 143-153; Kennedy, 1987, p. 342). Germany launched a macroeconomic imbalance to maintain the pace of her global project and approached the abyss of the Great War.

4. Evolution and integration of Global Network

Additional to intermediation of minerals, international banks were activated their business network, which stretched from Berlin to New York, to develop an investments in mining regional companies and intermediation or underwriting of government debt. These loans were to overcome the fiscal imbalances of the governments in the region, when the export duties failed to funding public spending. That is, the relations between public authorities ($a_1, a_2, a_3, a_4, a_5, a_7$) and business in the extractive spaces was defined, first, with mining companies and subsequently with bankers (see Figure 3).

From this, were defined three forms of interaction of bankers in the region, represented by the network of the international financial system ($F$). First, it was the connection that was made in the region with merchant bankers coming from the centres of commerce and shipping: Hamburg, Liverpool, London and Glasgow, consolidated from a hybrid structure and diversified that facilitated the commercial transactions of bankers, traders, producers, transporters and new entrepreneurs of world trade (Jones, 2000, pp. 35-43). Although there are a variety of firms in the group of merchant banks, are the following: Balfour Williamson & Co ($s_{19}$) was active on the west coast of America, especially the United
States, Chile and Peru, in the grain trade, coal, as board members of some mining and cement companies.⁸

Figure 3. Andean Extractive Space Network (A)
Source: Development by author. See (Gross & Yellen, 2006; Hsu & Lin, 2009; Jackson, 2008)

Duncan Fox & Co (s20), with its business of rescue of minerals, transport lines, export and import between Chilean ports and Liverpool, the representation of insurance companies and securities brokerage.⁹ Antony Gibbs & Sons (s24), that began with the textile trade to South America, moved to monopoly of guano in Peru, and then to nitrate plants, railways and credits in the region. Also had European and American representations of companies of mining machinery, and investments in infrastructure, storage and transportation in the ports of Antofagasta, Mejillones and Iquique.

WR Grace & Co. (s22) developed the mineral business, agricultural business, transportation, funding activities and loan intermediation (Chapman, 1985, pp. 236-238; Contreras, 2000, p. 201; Couyoumdjian, 2000, pp. 43-45; Estrada, 2006, p. 72; Joslin, 1963, p. 85). This firm with a permanent interest in complementary sectors to penetrate its businesses (Clayton, 1985, p. 178) and an important influence in the region, became an

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⁸ The Valparaiso office, Williamson Balfour, was highlighted by the intermediation of US corn in its early years, the import of British chemists, coal of Australia, investment in small flour mills until its final transformation into an investment company with interests in strategic minerals of the region (LBA F/5/b/1.0/#4698; LBA F/5/b/3.0/#9052-#9053).

⁹ They were present at the acquisition by Patiño of Compañía Estannífera de Llallagua on the Santiago Stock Exchange (Granados, 2014, p. 52).
active correspondent for US banks, which expanded their interests and changed their perspectives to what would be the opening of the Panama Canal (TMLM, ARC1195, Box 4, 4/2). By 1901, JP Morgan & Co. (s16) agree to participate in the purchase of shares, with its allied company in London JS Morgan & Co. (s21), of Chile Transandine Construction Company, where also associated with Grace (TMLM, ARC110, p.22). However, the arrival of JP Morgan concentrated on syndicated resources for railways operations, government loans and copper mining.

Secondly, interaction with local commercial banks depended on the ability to develop business across the mining industry, and as a result Bolivia had five national banks, Peru had eight and Chile had eleven before starting the Great War. Local banks (a11) in the extractive spaces were different. In the case of Bolivia were: Banco Industrial de Bolivia, Banco Nacional de Bolivia, Banco Francisco Argandoña, Banco Agrícola and thereafter Banco Mercantil (HGDB, K01/0796). These banks attended the needs of the Bolivian economy, which showed a bank concentration and weak production structure beyond mining.

The local banking system of Peru, severely affected by the War of Pacific maintained the Banco del Callao as the only bank until the arrival of the Banco Italiano in 1889 and the establishment of a new financial law the same year, promoted by the banker Jose Payan and De Reyna. This law was established definitively in 1895 with political stability (Thorp & Bertram, 1978, pp. 35-36). However, early the twentieth century, only two banks had been founded: The Banco Internacional in 1897 and Banco Popular in 1899. The two banks were created by agricultural and mining elites in partnership with merchant banks as WR Grace & Co., that quickly entered the stock market boom and government funding (Karno, 1970, pp. 50-56).
Figure 4a. *International Financial System Network* only banks (S)

Figure 4b. *International Financial System Network* (F)

*Source:* Development by author. See (Gross & Yellen, 2006, pp. 52-54; Hsu & Lin, 2009; Jackson, 2008)
While in Chile, for 1885 there were six banks had a capital above of one million of Chilean pesos equivalent to slightly more than 500,000 US dollars of the date. By 1905 were more than 17 banks had a capital above of one million of Chilean pesos such as Banco de Chile with a capital of USD 64.9 millions, Nacel with 11.9 millions, Mobiliario 8.2 millions, De la República 7.7 million and A. Edwards with 7.2 million. This facilitated the advance of mining, copper expansion and the transfer of ownership of mineral production to the British and German control, with ventures funded locally, with foreign investment and public debt in international markets (Cademartori, 1968, pp. 63-4). The British funding represented USD 66.8 million by 1895 and 172.2 million in 1913 (Stone, 1977, p. 706), where Rothschild dominated credit operations from 1886 to 1896 (TRA, 000/401E/14).

Third, the arrival of other international banks to participate in financing transactions in the region which had led by Rothschild and Barings (s6) and to a lesser extent some merchant houses. Private and joint-stock banks, as Crédit Mobilier (s13), Société Générale (s14), Paribas (s21), and to a lesser extent Comptoir National d’Escompte of France, the British bank Schröeder & Co. (s18), the South American Group (s15) shaped by banks JP Morgan, Kuhn Loeb, First National Bank and National City Bank of United States, and sometimes accompanied by the allied company JS Morgan & Co in London (s22), that in 1909 it became Morgan Grenfell & Co. As countless joint-stock banks created especially for the region, who sought to participate in this business network.

The Banks that were developed operations actively in the region were: Anglo-South American Bank (s10), Deutsche Überseeische Bank (s8a) subsidiary of Deutsche Bank for

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10 The rate of change of date was used to convert the original figures of (Sutter & Sunkel, 1982, p. 122) to US dollars.
11 The Anglo-South American Bank was installed indirectly in Chile in 1888, after the acquisition of Bank of Tarapaca and London, bank that was initially funded by the Rothschilds (TRA, XI/38/38). Its merger in 1900 with Anglo Argentine Bank established in 1889, created the Bank of Tarapaca & Argentine, which for 1906 would change its name to Anglo-South American Bank (Jones, 1993, pp. 404-409). By 1914 it had twenty-four offices: seventeen in Chile, four in Argentina, one in Uruguay and the agency in Oruro (LBA, F/4/b/6.0/#4678). This network of offices connected with a correspondent network where the Banco Mercantil de Oruro founded by Patiño would be one of them. The Anglo-South was meant to have a close contact with its main client, Simón Patiño.
South America,\footnote{The Deutsche Überseeische Bank began its expansion in the region in 1886. It established at Chile in 1896 and Bolivia in 1905. For 1913, had nine offices in Chile, six in Argentina, four in Peru, three in Brazil, two in Bolivia and one in Uruguay. In Bolivia it remained until the withdrawal of Anglo South American Bank as the only foreign bank in Bolivia because Bank für Chile und Deutschland closed the La Paz office in 1910 and Oruro office in 1914 (HGDB, GB01/B10; HGDB, K01/0796; HGDB, S3775).} Bank für Chile und Deutschland (s9a) a joint venture between Disconto-Geselleschaft of Berlin (s9) and Norddeutsche Bank of Hamburg.\footnote{This bank was founded in 1895 in Hamburg for operations in Chile. On the recommendation of the local directory, through a letter of March 25, 1905, the offices of La Paz in September 29 and Oruro in October 12 of the same year open their doors because they saw that the region had a potential of lucrative business (HGDB, S3774; HGDB, K01/0795; HGDB, K01/0796).} To a lesser extent, the joint venture of Bank of Peru and London,\footnote{This bank was the transformation of Banco del Callao in 1897 and the merger with The London Bank of Mexico and South America. By 1914, Peruvian's share was 30 per cent, French was 44 per cent and British investors were 16 per cent (Bollinger, 1971, p. 234).} and Bank of Bolivia and London.\footnote{The Bank of Bolivia and London was a joint venture between W.R. Grace & Co., The London Bank of Mexico and South America, Bank of Peru and London and Le banque français pour la commerce et l'industrie; (Antezana, 2003, p. 39; Briones & Villela, 2006, pp. 335-336; Joslin, 1963, pp. 196, 213).} Banks, that as mentions Young (1991, pp. 81-85) started strong competition in the region, although the capital structure was stronger in British banks than in German and other international banks. From this link of banks and great local mining companies, headed by the elite as Patiño, Aramayo, Edwards,\footnote{Agustín Edwards linked external markets and funding sources under a single structure of merchant banking, the bank of Valparaiso A. Edwards & Co. that facilitated the Chilean mining progress. This bank would later acquired by The Anglo South American Bank in July 1920 when bought the 60 per cent of the bank's shares (Joslin, 1963, p. 259) (Sutter & Sunkel, 1982, pp. 72, 122). In 1920 was established a strategic alliance and later Agustín Edwards was appointed Director of Anglo South American Bank from October 1926 until October 1935 when he was appointed ambassador of Chile in London and a year before settlement and acquisition of the Bank by the Bank of London & South America (LBA, F/4/b/1.2/#4671).} Concha, Backus, Johnston, facilitated the business development of international bankers favoured by the centralization of extractive business and the importance of export duties in public revenues. If banks only had links between them, the network presented the features of Figure 4a. However for this case, was used the network \((F)\) that had links with other agents of global network, both mining companies and governments (see Figure 4b).

Bolivia's large mining companies influenced directly, were the owners of all the tin vertical structure and the accumulation allowed them to influence of public and international affairs and international markets (Granados, 2014, pp. 72-73). While in Peru and Chile, domestic firms had managed to develop their fortunes in the foreign trade of
minerals, because there was no industrial capacity to absorb extractive activity, and were international companies that led the industrialization of minerals.

Because of this, the British and German influence in Chilean public affairs was necessary to advance his economic consolidation, where the association with local families facilitated the development of the extractive business. An example of this was the pier Melbourne Clark & Co, where Edwards, Ossa and Puelma participated with Antony Gibbs & Sons (O'Brien, 1980, p. 7). Like other association schemes, such as those achieving Grace, before the default of Peru, and his deteriorating fiscal situation at the end of the War of Pacific, which led him to get the rail concession in exchange for the restructuring of the Peruvian debt that achieved with his international banking network, led by Barings in London (Miller, 1976, p. 88; Secada, 1985, p. 602) and his relation in nitrate business, and general, in Peruvian business (TBA, HC4.11.28; TBA, HC4.3.21; TBA, HC4.3.18.2).

In Bolivia the influence was exerted directly by local mining families and their ability to define the key public officers at the time that were not protected their interests. The influence of Patiño and Aramayo established a common factor and was the defence of mining interests of any political demonstration that affect them. However, the fiscal deficit was a common factor that made that many bankers came to achieve solve the situation, both in Bolivia, Peru and Chile. By 1909, after being approved external credit through the Law of November 1908 by the Bolivian Congress, was structured a transaction for 500,000 pounds, which was an operation created by WR Grace & Co., and syndicated by JP Morgan, with the support of JS Morgan, First National Bank, National City Bank, where each entity took a fifth, with a coupon of 6 per cent and a value of 90 per cent (TMLM, ARC 112, p. 84).
Figure 5. *Global Network (WG), 1900-1914*

*Note:* Conventions. Germany (G): $g_1$: Wilhelm II, $g_2$: Kanzler, $g_3$: Reichstag, $g_4$: Gelsenkirchener Bergwerks, $g_5$: Tyssen, $g_6$: Krupp, $g_7$: Zinnwerke Wilhelmsburg, $g_8$: DEGUSSA, $g_9$: Norddeutsche Affinerie, $g_{10}$: Aron Hirsch & Sohn, $g_{11}$: Metallgesellschaft, $g_{12}$: Beer Sadheimer & Co.

Extractive Spaces (A): $a_1$: Executive Power, $a_2$: President, $a_3$: Legislative Power, $a_4$: Local Authorities, $a_5$: Military Forces, $a_6$: Local Banks, $a_7$: Judiciary, $a_8$: Transport Companies, $a_9$: Local mining companies (medium miners), $a_{10}$: International Companies or Great Miners, $a_{11}$: Small miners, $a_{12}$: Merchant houses (rescatadores).

International Financial System (S): $s_1$: Mendelssohn & Co., $s_2$: Bleichröder, $s_3$: Speyer Brothers & Co., $s_4$: N.M. Warburg & Co., $s_5$: N.M. Rothschild & Sons, $s_6$: Baring Brothers & Co., $s_7$: Dresdner Bank, $s_8$: Deutsche Bank, $s_{8a}$: Deutsche Überseeische Bank, $s_9$: Diskonto Gesellschaft, $s_{9a}$: Bank für Chile und Deutschland, $s_{10}$: Commerz Bank, $s_{11}$: Anglo South American Bank, $s_{12}$: Berliner Handelsgesellschaft, $s_{13}$: Crédit Mobiliier, $s_{14}$: Schatthausen’sche Bankverein, $s_{15}$: Société Générale, $s_{16}$: South American Group (National City Bank, Kuhn Loeb & Co., JP Morgan & Co., First National Bank), $s_{17}$: Darmstädter Bank, $s_{18}$: Schröder & Co., $s_{19}$: Balfour Williamson, $s_{20}$: Duncan Fox, $s_{21}$: Paribas, $s_{22}$: W.R. Grace & Co., $s_{23}$: Morgan Grenfell & Co., $s_{24}$: Anthony Gibbs & Sons.

Peru was incorporated into the global network on two fronts. First the influence of Grace in public and fiscal affairs, backed by his international banking network, and the arrival of US mining companies, who interacted with the German investment and refiners in Hamburg and Frankfurt. Peru did not submit a high export concentration, and landowners continued being relevant to public affairs and would be the international entrepreneurs who would lead mining.

The integration of extractive spaces of Bolivia, Peru and Chile, and German industrial space, analysed as topological spaces, facilitated the flow and convergence of strategic materials to processing centres. While the raw material was in the Andean countries, the innovation process and industrial development was concentrated in Germany. With the exception of companies of Aramayo and Patiño, and multinational companies in Chile and Peru \((a_{10})\), who with the outsourcing of engineers and specialists or foreign employees, participated in the network of knowledge and research.

The international banks \((F)\) were, the agents who led the integration of these spaces (see Figure 5) and dynamized of global network, through support to some mining companies to consolidate share ownership and control over capital flows result of the export of strategic materials.\(^{17}\) While in Bolivia, tin entrepreneurs achieve their objectives by generating some negative externalities to the government \((a_1)\). In Chile and Peru, mining was based on foreign investment and merchant banks who developed the mining business. Finally, Germany was able to consolidate industrial development, and the international financial system grew in the number of businesses and their ability to accumulate capital.\(^{18}\)

5. Conclusion

In this paper used the networks analysis and complex systems. This mathematical and graphical modelling of a historical problematic allowed identifying the dynamics of the

\(^{17}\) An analysis of the interaction of elites from an interpretation of network theory, see (Carroll & Sapinski, 2011, p. 192)

\(^{18}\) To further explore the efficiency, inefficiency and network externalities, see (Jackson, Social and Economic Networks, 2008, pp. 157-63)
international financial system in the Andean extractive spaces exploitation and its relationship to the industrial development of Germany before the outbreak of the First World War. Banks were the core of this process, as they through their network of bankers, entrepreneurs and specialists, as well as capital, managed to boost the export economy, through the development of the extraction business, corporate and government funding, and investment in project finance of transportation and exploration.

The demand for industrial raw materials facilitated the entry of Andean countries to international markets, although differences in the intensity, interaction, dynamics and complexity of networks for the mineral extraction, were able to determine common parameters allowed to establish the importance that had these raw materials for industrial strategy and the German imperial project. This came from an industrial planning process, linked to a diplomatic strategy and banking expansion that facilitated the acquisition of strategic minerals through investment or funding. The model is useful because it identifies the German advance in the region, and the banks goals, in their eagerness to participate in a strategic business for central economies.

The model identified, also, that exporting economies in South America were linked to international political processes, inasmuch as these materials were instrumental in the military and naval consolidation of the central economies, and regardless of the complexity of the region, the trade was achieved to develop and attract the most prestigious international bankers. Although the trade volumes both in quantity and value, were not as representative as exports from Brazil and Argentina.

Finally, international banks participated in the extractive spaces, but it was the governments that attending to the constant funding generated by an inefficient management of fiscal policy and the resources obtained from mining, where corruption played a leading role. The bankers developed symmetrical relationships and never showed a monopoly or the centrality of one of them, as had happened in previous periods and extractive booms during the nineteenth century. That is, was integrated the mining knowledge and bankers capital. This benefit was generated by the arrival on the scene of several banks of the
central economies, which saw the importance of participating in the extraction of minerals, not only from the trading activity but also for innovation and technological progress, essential in a period of tensions and rivalries.

Archival Sources

The Baring Archive (TAB). London, England
The Rothschild Archive (TRA). London, England
Lloyds Banking Group Archive (LBGA). London, England
Historisches Archiv der Deutschen Bank (HADB). Frankfurt, Germany
The Morgan Library and Museum (TMLM). New York, United States

Bibliography


