

# AN ECONOMIC AND INDUSTRIAL MOBILISATION ANALYSIS OF EUROPEAN POST-NAPOLEONIC MILITARY CONFLICTS 1853-1871

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## *1. Introduction*

The aspiration of the current paper is to analyze the three major post-Napoleonic European conflicts. These were the Crimean War (1853-1856), the Prussian-Austrian war (1866) and the Prussian-French war (1870-1871) from their economics perspective. We aim to demonstrate that behind military success in the battlefield there is always an efficient economic-industrial mobilization. The structure of the paper is as follows: In the first section we provide a theoretical framework in order to analyze the conflict. We use the Diamond Model and the Square of Power Model as our theoretical models. The second section provides, an overview of the conflicts, and demonstrates the economic forces which influenced the outcome. Conclusions follow providing a nexus between the theory and the case study.

## *2. Victory or defeat in war and the economic forces: Theoretical frameworks*

The industrial revolution generated a new type of warfare which has been defined as “total war”. The concept has been analyzed by many scholars which have provided various definitions; however one can state that total war involves all forces of the nation and includes both the military personnel and the civilian population.<sup>1</sup> Two main models can be used for the analysis of economics and warfare. The former is the Diamond Model; whereas the latter is the New Institutional Economics (NIEs), Square of Power Model. The Diamond is originally a model which aims to examine the competitiveness of any economy in the

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1. For the theoretical definition of total war see: R. Chikering: “Total War. The Use and Abuse of a Concept”, in the volume: Manfred F. Boemeke & Roger Chickering & Stig Förster (eds.) (1999): “Anticipating Total War. The German and American Experiences 1871-1914”, Cambridge University Press and the German Historical Institute, pages 13-28.

international economic system; however this model can capture very well the nexus between the real economy and the military apparatus of any nation during warfare. The second model; that of the Square of Power, captures the nexus between the financial sphere of the economy and the military apparatus of any nation during the era of warfare.

### *2a. The Diamond Model*

The model has four elements:

**Production factors:** Every economy has a certain level of Capital, Labour, Technology, space with certain natural resources. These factors will change when war erupts. We expect that capital will be reduced due to enemy bombardment; labour will also change since men will become soldiers (traditionally men were replaced by women in factories, transportation, agricultural facilities etc.).

Turning to technology the machine tools inside the various industries before the war have to be ideally modern in order to ensure maximum productivity. Turning to space and natural resources the war will either end in conquering space and land from the enemy; or vice versa. In the first case if the conquering territories are not “scorched earth” they can be useful to the war effort; if however they are fully or partially perished their use is limited. In the second case the opposite occurs.

**Demand Conditions:** The economy during the war will have to meet the enormous demand for consumer products and military hardware for the front at the same time. If the economy is maximizing the production of military hardware (guns, ammunitions, etc.) and marginalizes the production of consumer goods this will result in shortages in the home front and this will trigger public dissatisfaction which will result in the Clausewitz assertion that the public dissatisfaction will sooner or later force the leaders to seek for a diplomatic solution to the conflict in spite of what is occurring at the tactical level.

**Related and Supporting Industries (and services):** During war the so-called related and supporting industries have a crucial role to play. Obviously we do not refer to defense industry or to other crucial industries like steel, oil, petrochemicals, coal [historically] etc. it goes without saying that the more developed these are the better the chances to prevail in the war. We are talking here about other industries (or services) like the fire-brigade. In war thousands of fires will erupt due to enemy bombardment. The better equipped the fire-brigade from the era

of peace; the less damage will occur in the era of war. Another example is the case of the telecommunication industries. The use of telegraphic services was more extended in the Prussian army whereas the French was still dependent on pigeons. The transportation network is an additional advantage.

The NHS (National Health System) is an additional asset. During the era of war any society will have thousands of wounded civilians and soldiers. Furthermore we can anticipate spread of diseases either through enemy activity (via chemical warfare attacks) or simply because living and medical conditions will deteriorate. The ability of the Health System to cope with multiple cases of wounded humans and the ability of the pharmaceutical industries to maximise production of medical equipment as well as drugs is key for victory.

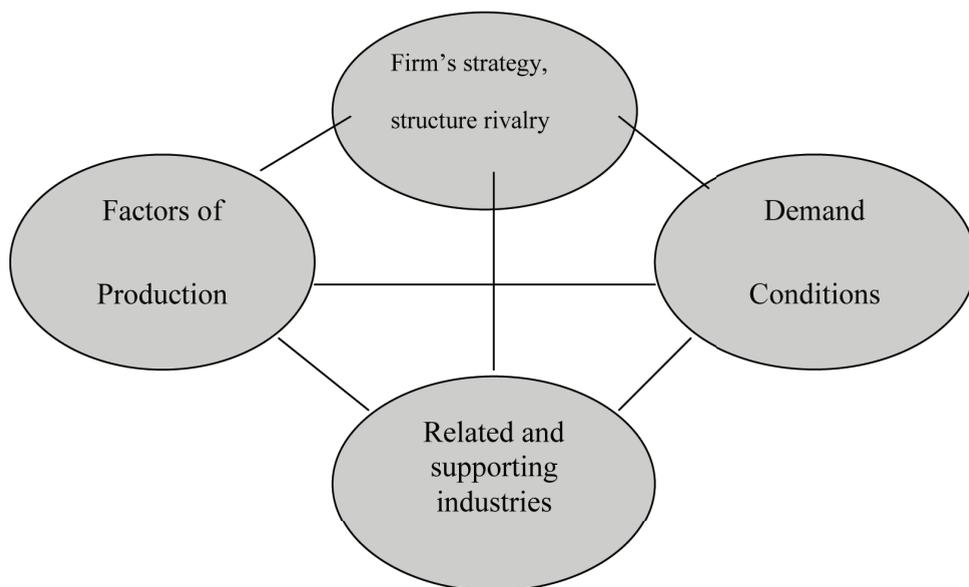
Finally agriculture is an additional related and supporting industry. The Napoleonic assertion that “an army marches on its stomach” is well known; however agricultural supplies are needed for the home front as well. To illustrate the naval blockade which the North imposed on the South had catastrophic results for the food consumption as well as for food prices and production volumes.

**Firm’s strategy, structure, rivalry:** The final aspect of the Diamond is the role of the private sector and of entrepreneurship. It is well known that during the era of peace firms aim to maximize profits either via cost reduction strategies or via qualitative superiority, marketing etc. The question is what is the role of the enterprise during war? Is it still business as usual or there is a social responsibility for the enterprise and the entrepreneur? A typical example comes from the Russian defence industry in WWI. When the war erupted the Russian army had a huge deficit in small fire arms and ammunition. The Russian state industries like Putilov did not have the ability to produce *en mass* thus the Russian Emperor asked the private enterprises to increase their production of fire-arms. However many private entrepreneurs took the state funds but instead of investing them to production lines they bought the local agricultural production and sold it back to the black market. A typical example is the case of the Revdinskoye industries in the Urals.<sup>2</sup> So what the private entrepreneur will do is essential, for victory or defeat in war. In the case of the above conflicts the role of individual entrepreneurs is not well researched. Thus no concrete outcomes can be deducted. The Model is demonstrated in Figure 1.

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2. See: N. Stone: “The Eastern Front 1914-1917”, Penguin, London, 1998, page 197.

Figure 1. The Diamond Model



Source: M. Porter: "The Competitive Advantage of Nations", MacMillan Press, London 1990, page 72.

However it is not just the real economy which contributes to victory or defeat in war but it is also the financial sphere of the economy. A war - which in the majority of cases last longer from what is anticipated by pre-war planners has to be financed and there are three ways to finance war: a) via taxes, b) via loans (domestic or international), c) via increased money supply. In order to capture these we need to address the second model that of Square of Power.

#### 2b. The Square of Power model and NIE (New Institutional Economics)

The Square of Power model has also four elements. These are as follows:

**Bureaucracy-Tax Authorities:** Any war can theoretically be financed exclusively by taxation. However, if this is the case, then heavy taxation will create social unrest and eventually, the government will be forced to seek a diplomatic solution. The second issue associated with taxation is the efficiency of the tax authorities per se. If taxes are not collected fully during the era of peace they shall be collected during war times?

**National Debt/ Money Markets:** The second way to finance a war is via in-

ternal or external loans. If the option of internal loans is exercised this requires adequate level of savings from the era of peace. If the citizens do not save during peace or they are in debt how can they finance a war? If this is the case then interal financing is impossible and the government has to offer any bonds to international markets and investors. In this case the optimum strategy is that the loans have a long-time duration with low interest rates. The opposite option (i.e, short-time duration and high interest) is not desirable. However the international investors will buy the bonds in time of uncertainty only if the state entered the war with low public debt.

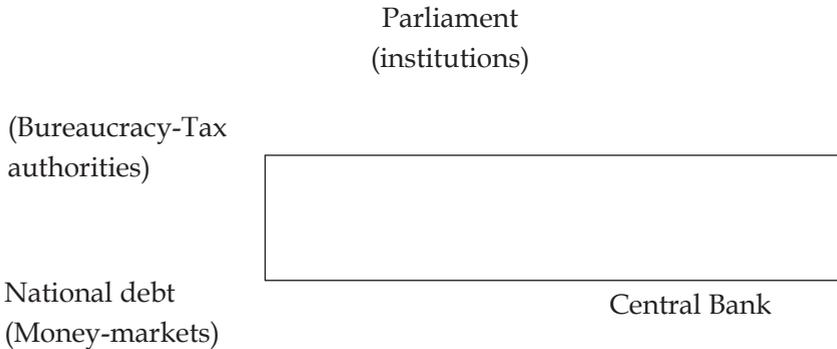
**Money Supply-Central Banks:** The third way to finance a war is historically the excess print of money by the central bank (i.e. excess money supply). However especially under gold standard the excess money supply triggered hyperinflation thus triggered social unrest.

**Institutions and Parliament:** The fourth invisible force which will determine victory or defeat in war is associated with institutions. There are two dimensions here. The first is the quality of civil-military relations. WHO DECIDES IN WAR? The answer to this question by the German General Staff has been that the commander in chief at the tactical theatre of operations has the freedom to take all the necessary decisions in order to achieve victory. Opposite to this rationale is the well-known phrase that: "War is a too serious matter to entrust it to military men", by Clemenceau. The institutional conflict is obvious. However there is a second dimension about institutions and how they affect war. In a democracy various political parties will win elections and rule for a certain period of time. Obviously all political parties have voters (supporters) which belong to certain social classes; and social classes have conflicting interests. The main task of the Parliament is to legislate and the crucial question according to the NIE paradigm is if the parliamentary majority will legislate in order to support exclusively the interests of its own voters or if the legislation will try to compromise conflicting social interests. In the first case, when the interests only of the voters of the specific party which won the election are satisfied, class struggle will increase since the interests of other social classes are marginalised. In this case social instability (violence, strikes, demonstrations etc.) will certainly decrease the growth rate of the economy and will also have a harmful effect on the morale of the population in case of war.

If the opposite occurs (i.e. a social compromise via the legislation) then all social classes will be satisfied. This will create a stable social environment which

will promote economic growth and the morale for sacrifices will be high in case of war. The Model is depicted in Table 2.

Figure 2: *The Square of Power Model*



Source: Niall Ferguson: *"The Cash Nexus Money and Power in the Modern World 1700-2000"*, Penguin, 2002, page 16.

The above two models analyse the nexus between economics and warfare at the strategic level. The above analysis demonstrates that in conventional wars which have a long time duration the side with the limited resources is in most cases doomed to fail. According to one study during the period 1800-1849 in the 88.2% of armed conflicts the "strong side" prevailed on the "weak". During the 1850-1899 period in the 79.5% of conflicts the "strong" prevailed over the "weak". During the period 1900-1949, in the case of 65% of conflicts the strong prevailed. The situation is reversed during the period 1950-1999, when the weak prevail on the 51.2% of conflicts. For the whole period 1800-2003 in the 71.5% of conflicts the "strong" prevail over the weak.<sup>3</sup> The only chance that the "weak" have to prevail in war is to mobilize the maximum of their limited resources (manpower, economic, financial, industrial etc) sooner than the stronger side; thus create a window of opportunity for specific time which will allow them to achieve a decisive blow to the stronger enemy. The other optional strategy is to achieve the attrition of the stronger opponent via guerrilla warfare. As already

3. See: Ivan Arreguin-Toft: *"How the Weak Win Wars. A Theory of Assymetric Conflict"*, Cambridge University Press 2005. For the 1800-1849 period 34 conflicts are examines, for the 1850-1899 period, 78 conflicts are examined, for the 1900-1949 period 43 conflicts are examines, and the same number of conflicts is examined for the 1950-1999 period. In total for the 1800-2003 period 200 conflicts are examined.

stated we focus in the following conflicts: The Crimean War (1854-1856), the Austro-Prussian war (1866) and the Franco-Prussian war (1870-1871).

### *3. Case-Study Analysis-The major European conflicts of 19th century*

#### *3.1. The Crimean War (1853-1856)*

The Crimean War started as a war between the Ottoman and the Russian Empires (October 4<sup>th</sup> 1853), when Ottoman forces invaded Russian occupied Romania. After eleven months Britain and France intervened in favour of the Ottoman Empire. The war terminated in 1856 without any clear winner, with almost equal losses on both sides and with no clear diplomatic advantage.

The conflict demonstrates the nexus between economics and military strategy and tactics. To begin with Russia the country in 1853 had an Army of 1,100,000 men and could mobilize another 800,000 men; however there were only 1,000,000 rifles (and from those the 533,000 were of old technology). The Russian defence industry had just three rifle factories with an annual production capacity of 61,000 rifles each (thus an annual total of just 183,000 rifles, many of them with defects). To illustrate in 1854 the Warsaw Factory send 1,500 rifles to Sevastopol and from those the 1,490 were defective! In addition the quality of Russian powder for artillery shells was low. Russian production of shells and powder increased fifth-fold between 1853-1855, but could not be compared with that of Britain and France. Thus the Russian side was forced to order arms and ammunition in the USA; these however were delivered after the termination of the conflict. The state of the Russian artillery is easily portrayed from the fact that in Sevastopol, between April 9-14 1855, the Allies deployed 500 guns and used 168,700 shells against the Russians. The Russian side had 1,000 guns but used less than 50% of the shells. When the Allies started their final attack against Sevastopol on June 18<sup>th</sup> 1855 (anniversary of the battle of Waterloo), and continued until September 9<sup>th</sup> they had at their disposal 800 guns and consumed the astonishing number of 75,000 shells per day. In the last days of the battle (between 5-8 September) the daily shell consumption of the British-French artillery was almost 100,000 shells. Against this immense fire power the Russian artillery in August was able to fire only 12,500 shells per day.<sup>4</sup> By the end of the war Russia had only 90,000 operational rifles and from a total of 1,656 field guns only 253 were operational.<sup>5</sup>

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4. See: Clive Ponting: "The Crimean War", Pimlico, 2005, pages 27-28, 204-205, 260-261, 280, 293 and 319-320.

5. See: P. Kennedy: "The Rise and Fall of the Great Powers", Fontana Press, 1989, p. 224.

However it was not just the Russian war industry problematic, war finance was also a problem. Britain increased its defence spending from £9 m. in 1853 to £76 m. in 1854 and reduced them to £35 m. in each of the following two years (1855 and 1856). French defence spending more than doubled during the 1854-1855 (when compared to those of 1853). Russian defence spending were almost doubled between 1852-1854, but no further increase occurred.<sup>6</sup> The British started the war with a short term loan of £450,000, was soon forced to increase taxes in order to finance the war cost. However in spite of the higher taxation in 1854 there was a £6.2 m. deficit which was financed via new war-bonds and in 1855 the deficit was increased to £22.7 m. The role of the Rothschild banking institute was pivotal. In the French case the first war finance credit came from a loan of 250 m. francs; two more loans followed, one of 500 m. and another of 750 m. francs respectively. Again Rothschild role was pivotal. At this point it is important to stress that the British Rothschild branch had greater participation to French loans compared to the French branch. In addition the role of the Credit Mobilier Bank was critical to the French effort.<sup>7</sup> The British and the French financed also the war effort of the Ottoman Empire with loans. The first Turkish loan worth 10 m. French Francs was given at the start of the war and a second of £3 m. was given in the summer of 1854. This loan was financed from a banking consortium between the "Black & Durrand" Bank and the "Goldschmidt Bischoffhein" Bank. However investors were reluctant to buy Ottoman bonds although these were covered by the copper mines production of the Ottoman Empire. In June 1855 another loan of £5 m. was given to the Ottomans this time under British and French state guarantee; however these bonds were rejected by the Rothschild. Thank to British and French money the Ottoman Empire deployed 400,000 front line men with modern equipment, artillery and adequate ammunition. However the Ottoman Army suffered from under supply of food, medicine, and from poor soldiers pay.<sup>8</sup>

Turning to Russia it is essential to point out that before the war the main financier of Russian Treasury was the British bank of Barings. Just before the start of the war Barings withdraw from the Bank of England £700,000 from the total

6. See: Clive Ponting: "The Crimean War", Pimlico, 2005, p. 204.

7. See: 1) Niall Ferguson: "The World's Banker The History of the House of Rothschild", Weidenfeld & Nicolson, 1998, p. 582-584, 2) Clive Ponting: "The Crimean War", Pimlico, 2005, p. 11.

8. See: 1) Niall Ferguson: "The World's Banker The History of the House of Rothschild", Weidenfeld & Nicolson, 1998, p. 584-585, 2) Clive Ponting: "The Crimean War", Pimlico, 2005, p. 26-27, 206.

£1 m. which represented Russian government deposits and shipped the gold to Dutch banks. During the war the Bank secretly financed Russia with 50 m. roubles. In addition Barings turned down French bonds worth of 500 m. francs although this finance would have been done jointly with the Rothschild's. These move had a clear entrepreneurial motive since the Bank wanted to develop the Russian railway network. When the war terminated Barings was the first bank which financed with £40 m. the development of a Russian railway network of 2,500 miles long. However when the British press unmasked the deal there was a severe criticism from the political parties as well as the general public and the investment project was perished.<sup>9</sup>

Against the combined might of Britain, France and Ottoman Turkey, Russia could just deploy huge numbers of soldiers but did not possess the industrial or the financial resources which the war demanded. It is estimated that the Russian Treasury financed the war with the sum of 250-300 m. roubles which was rather limited.<sup>10</sup> The war proved the importance of money supply and the war industry. The Russian side neglected the pre-war industrial production; thus not being able to sustain the human and material losses was forced to seek peace. It is important to stress that the Crimean War was not an isolated conflict in the Crimea. Hostilities occurred in the Baltic, in the Pacific and in other regions between the Russian forces and the British-French fleet, creating additional strain to Russia and increasing the overall cost of the war.<sup>11</sup>

### 3.2. *The Austrian-Prussian War (1866)*

The Austrian-Prussian war although short in terms of time duration has the

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9. See: Philip Ziegler: "The Sixth Power: Barings, 1762-1929", William Collins, London, 1988, p. 172-178.

10. The exact Russian defence spending is unknown but aggregate Russian public spending increased from 280 m. roubles in 1852, to 313 m. in 1853, to 384 m. in 1854 and 526 m. in 1855. See: Niall Ferguson: "The World's Banker The History of the House of Rothschild", Weidenfeld & Nicolson, 1998, p. 582. These data differ from those of P. Kennedy: "The Rise and Fall of the Great Powers", 1989, p. 224 who points out that annual Russian defence spending was 500 m. roubles during the period 1854-1855, The same source provides an aggregate defence expenditure for Britain during the 1853-1856 at £154,2 m, for France at £,127.9 m. and for Russia at £128,9.

11. For an excellent analysis see: Andrew C. Rath: "The Global Dimensions of Britain and France's Crimean War Naval Campaigns against Russia, 1854-1856", Ph.D. thesis, McGill University, Montreal, November 2011.

traits of total war and demonstrates again the nexus between economics and military strategy. The overall balance of military power was marginally in favor of Austria which could deploy an army of 275,000 men against Prussia which could deploy a force of 214,000 men. In addition the Austrians during the war enjoyed complete artillery superiority since they could fire per day 2.2 shells, whereas the Prussian artillery could fire only 0.8 shells. Thus Austrian artillery fired 96,472 shells whereas the Prussian artillery fired 36,199 shells. On the other hand in the infantry the Prussian soldiers were better equipped compared to Austrians with better rifles. However the financial situation of Austria was bad. In 1865 the Austrian public debt was 1,670 million Thaler while the annual revenues were just 292 million. The debt repayments absorbed the 26% of Austrian revenues. The war of 1866 increased public spending to 668 million Thaler (a 1867 figure) which represented more than 220% of the state revenues of 1866. Austria simply could not afford to finance a war. To this one has to add the second front in Italy, the major defeat at the Bohemian village of Sadowa on July 3<sup>rd</sup> 1866 where total Austrian losses were 43,000 men and the better training of the Prussian army. Finally the Prussian army had five railway lines whereas the Austrians had just one. All these factors explain the Austrian defeat. The benefit of Prussia was clear since it became the eminent German speaking state among the Germanic world but in addition the Habsburgs were forced to pay 30 million silver florins (\$405 m.) to the Prussian state bank in Oppeln, and thus providing immense assistance to the Prussian budget which was in deficit.<sup>12</sup> However it was not just Austria which had to pay an indemnity. The city of Frankfurt which was a principal ally to Austria was occupied by Prussian troops on July 16<sup>th</sup> and in the next day the Prussian authorities imposed an indemnity of 6 million gulden in the city which was paid in two days. After this an additional indemnity of 25 million was imposed.<sup>13</sup>

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12. For the war see: 1) S.F.W. Enderink: "Austria and Prussia German unification in the nineteenth century", MA Thesis June 2010, with excellent economic data 2) Robin Okey: "The Habsburg Monarchy", St. Martin Press, New York, 2001, p.185-190, 3) Geoffrey Wawro: "The Austro-Prussian War", Cambridge University Press, 1998, where he data about the war reparations are in p. 277 of this source. The data related to shell consumption were taken from: Benedict Crowell & Robert Forrest Wilson: "The Armies of Industry. Our Nation's manufacture of munitions for a world in arms 1917-1918", Volume I, New Haven, Yale University Press, 1921, p. 29 and 31. See also: Hew Strachan: "European Armies and the Conduct of War", Routledge 2005, p. 98.

13. See: Fritz Stern: "Gold and Iron. Bismarck, Bleichröder and the Building of

### 3.3. *The French-Prussian war (1870-1871)*

The French defeat in the 1870-1871 war with Prussia is attributed to the diplomatic genius of the Iron Chancellor Otto von Bismarck and on the professionalism of the Prussian military. However in this conflict economics also played an important role.

In 1866 the population of France was 38,067,000 inhabitants, whereas the population of the German states and principalities in 1864 was 35,567,000 inhabitants. Since the German states were not united the demographic difference although small was an important factor. The economic forces were marginally in favour of Prussia and the other German states. In 1869 French coal production was 13.5 m. Metric tons, whereas the German production was 34.4 m. metric tons. The French iron production in 1869, was 3,131,000 metric tons and the German production was 3,147,000 metric tons. The French production of pig-iron in 1869 was 1,381,000 metric tons and the German production was 1,313,000 metric tons. Finally the French steel production in 1870 was 84,000 metric tons, whereas the German production was 126,000 metric tons. However the German heavy industry of Krupp had a greater production of armaments compared to its counterpart the French Creusot. Finally the railway network was a crucial parameter. In 1869 the length of the French railway network was 16,465 km, whereas the length of the German railway network was 17,215 km. Thus in 1870 Prussia and the other German states had achieved a marginal economic superiority over France. However the German economic superiority was not united and the second important issue was associated with the transformation of economic power to military power. The military balance in theory created a picture of equality.

On July 1<sup>st</sup> 1870 the French Army had 3,216 field guns (of 12-pounder), 190 mitrailleuses type guns, 581 mountain guns, 3,379 smooth bore cannons and 12,356 guns howitzers and mortars.<sup>14</sup> The French Army in theory could easily gather a force of 400,000 men. When the general mobilization occurred (July 14<sup>th</sup> 1870) the results were very poor. The Army expected a force of 163,000 men in two weeks but the reality was that only 39,000 were enlisted. Between 16-26 July the French side mobilized 594 military trains which transported 186,000 men, 32,000 horses, 500 artillery guns, 1,000 ammunition wagons and 1,500 carts towards the French-German borders. By the end of July the French side had

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the German Empire”, Vintage Books, New York, 1979, p. 90. The gulden was the currency of Austria.

14. See: “Cassell’s History of the War between France and Germany 1870-1871”, Volume II, Cassell and Co. 1895, London 1895, p. 574 (no author provided).

deployed in the frontiers a force of 250,000 men with 912 artillery guns. This was a strong force but it was smaller compared to the initial military planning. The French however enjoyed a fire-power advantage. The French infantry was equipped with the Chassepot type rifle. The calibre of this weapon was 1,000-1,500 yards. According to one archival source in 1868 the state defence industries of France had produced 100 million Chassepot cartridges and the private manufactures had supplied another 100 million.<sup>15</sup> Every French infantry man had 105 rounds of ammunition. In addition there were another 144 machine-guns (Mitrailleuse-type), with a firepower of 125 rounds per minute and a range of 1,200 meters. French artillery on the other hand, was of low quality and the guns had a small range.

Against this force Prussia and the other German states which immediately allied with the Iron Kingdom deployed a total force of 1,200,000 men (300,000 men in the regular army, 400,000 men as reserve, and 500,000 men as Volksturm). By the end of July (in the first 15 days) the German side deployed a force of 350,000 men with 1,584 artillery guns thus achieving complete numerical superiority over the French. Every German soldier had just 70 rounds of ammunition for a Dreyse type rifle. This specific rifle had a range of just 400-600 yards. In artillery however the steel guns of Krupp were superior to those of France in terms of range.

The French side suffered its first defeats after August 7<sup>th</sup> 1870. The greatest defeat occurred in the town of Sedan on September 2 where the German side with losses of 9,000 men imposed on the French a total loss of over 120,000 men (3,000 dead, 14,000 wounded, 104,000 prisoners among them the French Emperor himself Napoleon III), 419 field guns, 139 fortress guns, over 1,000 wagons of ammunition and supplies, 6,000 horses.<sup>16</sup> The war continued until the armistice of January 26<sup>th</sup> 1871 and the final French defeat occurred by March 18<sup>th</sup> 1871.

The defeat was not just the outcome of tactical military errors or of the poor initial mobilization of the July 15-30 1870 period. Throughout the war the productivity of the French defence industry was very low. The monthly Chassepot rifle production was just 15,000-18,000 pieces. As a result the 1,500,000 rifles which the French Army used were of 15 different models, and many of outdated technology. The production of ammunition was also low (2,800,000 bullets / week in September, 4,500,000 bullets / week in December and 7,000,000 bullets

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15. See: John S.C. Abbot: "Prussia and the Franco-Prussian War", A.H. Hovey publishers, Toronto, 1871, p. 393.

16. See: Douglas Fermer: "Sedan 1870. The Eclipse of France", Pen & Sword Books, 2008, p.174.

in the first week of February, after the armistice). Turning to artillery production the Creusot industry was able to produce after the defeat of Sedan 250 artillery guns and 16 machine-gun batteries and the aggregate artillery production during the war was 1,400 pieces.<sup>17</sup>

The German victory was the outcome of an efficient industrial mobilization. Each soldier which at the beginning of the war was given 70 rounds, during the war was supplied with 200 rounds of ammunition. Throughout the war the German artillery used 670,000 shells. (The lowest daily consumption was 55 shells and the highest was 88 shells). These data demonstrate the high productivity of the ammunition industry.<sup>18</sup>

According to one archival source the logistical support of the German armies included between July 16<sup>th</sup> to December 31<sup>st</sup> 1870 400,000 letters and 9,090 papers per day. During the same period 41,000,000 thalers and 58,000 parcels of all sizes and weights were sent by the War Office to the German military authorities in France; and soldiers received from or sent to their relatives 13,000,000 thalers and 1,219,533 parcels making 22,173 parcels per day".<sup>19</sup> Turning to light arms the German industries had endorsed mass production techniques and the German steel machine guns were the best in Europe.

Finally the French invested in defence during the war whereas the Germans

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17. See: 1) William Serman: "French Mobilization in 1870", in the volume: S. Förster & J. Nagler (ed): "On the Road to Total War The American Civil War and the German Wars of Unification 1861-1871", Cambridge, 2002, p. 283-294, 2) W. Deist: "Remarks on the Preconditions to Waging War in Prussia-Germany, 1866-71", in the volume: S. Förster & J. Nagler (ed): "On the Road to Total War The American Civil War and the German Wars of Unification 1861-1871", Cambridge, 2002, p. 311-325.

18. See: H. Jager: "German Artillery of World War One", The Crowood Press, 2001, p. 194 and 217. For different data see: Martin Van Creveld: "Supplying War", Cambridge, 2004, p. 102 provides the figure of 199 shells per gun for the overall war period. According to this source the most intensive fire occurred in the battle of Mars-la-Tour (16 August 1870) where 222 guns fired 19,575 shells (88 shells per gun), whereas in Sedan (September 1 1870) 606 guns fired 33,134 shells (54 shells per gun). Finally according to Benedict Crowell & Robert Forrest Wilson: "The Armies of Industry. Our Nation's manufacture of munitions for a world in arms 1917-1918", Volume I, New Haven, Yale University Press, 1921, p. 29 and 31 the German artillery during the war fired 817,000 shells and the rate of German fire was 1.1 shells per day.

19. See: "Cassell's History of the War between France and Germany 1870-1871", Volume II, Cassell and Co. 1895, London 1895, p. 165 (no author provided).

had invested before the eruption of the war. To illustrate French pre-war defence spending was 420 m. francs. On July 16<sup>th</sup> 1870 additional sums of 50 m. were given and on the 21 July another 500 m. were allocated. On August 12<sup>th</sup> 1870, an additional sum of 1 billion was allocated; and another 250 m. came from the Bank of France. Total defence spending in France was 2.25 billion francs.<sup>20</sup> The French military effort was financed by the major banking houses (Banque de Paris, Credit Lyonnais, J.S. Morgan, Rothschild, Barings). Barings Bank financed with £2 m. The French government when the war ended and the same bank provided guarantees for £2.7 millions of Rothschild credit.<sup>21</sup> The situation of the French armaments, before and during the war, was extremely bad. According to one archival source: "An interesting debate on Army Contracts took place in the French Assembly in May 1872...The Committee had been at work for more than a year, and examined about two thousand contracts and accounts relating to an expenditure of 360,000,000 francs ... [the concluding remarks included the following:]...The state of the arsenals and military stores ...was deplorable. To maintain those 400 million [francs] had been voted annually, and 440 million had been assigned for the transformation of war material. It was said that there ought to have been 10,000 field-pieces [of artillery guns] in stock; but no more than 2,000 were found. Of muskets, 2,000,000 were unaccounted for. In 1870, no one knew what was [he] wanting, or what was missing".<sup>22</sup> The accusations related to corruption were immense. According to the source: "On the 21<sup>st</sup> of May [1871] ...M Rouher, who undertook the defence of the Empire said: "In the sitting of May 4<sup>th</sup> ...examining the question of contracts [reveals that] twenty-two of them were made by Count de Palikao; they apply to 447,000 rifles and 1,700,000 cartridges; and represent a sum of 167 million of francs. All these arrangements, with a single exception, contained a clause authorising their annulment in case of failure of delivery within a fortnight. Only two of them were in process of execution before September 4<sup>th</sup> representing altogether 823,000 francs. The completion of other contracts fell to ...the Government of the National Defence, for a sum of 48 million, from 25 to 30 million of which were

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20. See: William Serman: "French Mobilization in 1870", in the volume: S. Förster & J. Nagler (ed): "On the Road to Total War The American Civil War and the German Wars of Unification 1861-1871", Cambridge, 2002, p. 283-294, especially p. 288-289.

21. See: Niall Ferguson: "The World's Banker The History of the House of Rothschild", Weidenfeld & Nicolson, 1998, p. 729.

22. See: "Cassell's History of the War between France and Germany 1870-1871", Volume II, Cassell and Co. 1895, London 1895, p. 572-573. (no author provided).

carried out...[Another] contract was 32,000 muskets at 120 francs each [but with cartridges] the sum was 180 francs. At a later period, the Government of the National Defence purchased rifles at 190 francs...[another contract] placed [for] 1,500,000 cartridges, were in reality only magazines, so that it was not astonishing that the cartridges should have been deteriorated by humidity...".<sup>23</sup>

The German defence spending, -between 1859-1862- was 434.68 m Marks, and during the war another 1.5-2 billion Marks was expended.<sup>24</sup> The role of banking was important. The greatest part of defence spending was financed through bank loans. The main bank which bought Prussian bonds were the Disconto-Gesellschaft which experienced an immense increase of profits from 1.4 m. thaler in 1869 to 5,6 m. in 1871. Paradoxically the German branch of the Rothschild had a minor stake. (The Deutsche Bank also had a minor role since it was established only in March 1870).<sup>25</sup> The 1870 war is another proof that the nexus between defence industry and money can lead to victory.

According to another source: "The war alone had cost the French 12 billion francs (\$36 billion today), to which had to be added Bismarck's 5 billion francs indemnity...and the costs of wartime inflation that had quadrupled the French money supply...".<sup>26</sup> However another source points out that: "The financial cost of the war had been calculated at between 9 billion and 16 billion francs, or ten times the French annual budget in 1870. The cost included not only fighting the war (2.25 billion) but the war indemnities, the interest on them, and the cost of maintaining German troops during the occupation (totalling 5.7 billion), plus damage to property (0.56 billion), the cost of requisitions and taxes levied by the Germans, the servicing of government debt and pensions for the wounded".<sup>27</sup>

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23. See: "Cassell's History of the War between France and Germany 1870-1871", Volume II, Cassell and Co. 1895, London 1895, p. 572-574. (no author provided).

24. See: 1) M. Messerschmidt: "The Prussian Army from Reform to War", in the volume: S. Förster & J. Nagler (Ed): "On the Road to Total War: The American Civil War and the German Wars of Unification 1861-1871", Cambridge, p. 263-282 especially p. 267-268, 2) H.-J. Bontrup & N. Zdrovomyslaw: "Die Deutsche Rüstungsindustrie", Distel Verlag, 1988, p. 29.

25. See: 1) R. Lewinsohn: "The Profits of War", New York, 1937, p. 98, 2) Philip Ziegler: "The Sixth Power: Barings, 1762-1929", William Collins, London, 1988, p. 178.

26. See: Geoffrey Wawro: "The Franco-Prussian War. The German Conquest of France in 1870-1871", Cambridge University Press, 2003, p. 310.

27. See: Douglas Fermer: "France at Bay 1870-1871. The Struggle for Paris", Pen & Sword Books, 2011, p. 216. The complete fifteen points of the armistice between the two states can be found in Cassell's History of the War between France and

#### 4. Concluding Remarks: Economic models and victory versus defeat in warfare.

In our previous theoretical analysis we demonstrated that victory of defeat in conventional warfare is associated with a strong economy which has the following traits:

- Low debt or even better fiscal surpluses which can be invested in military build-up. This can mean higher salaries for the personnel (thus higher morale), good logistical support (adequate ammunition, medical supplies etc), good quality weapons etc.

- Developed defence industry which allows production of high quality weapons.

- Developed telecommunications and transportation system which assist initial military mobilization as well as the various military formations during the conflict.

- Private industries which support the war effort by denying trade with the enemy and by assisting the state mobilization. These industries may provide raw materials for various products or other intermediary and final products which are useful to the war effort.

- High quality Health Service and pharmaceutical industry which can support the military apparatus.

- Developed primary sector which guarantees adequate agricultural production and food supplies for the military and the civilian population.

- Social stability and minimum social tensions before the war.

- Controlled money supply which does not trigger hyperinflation thus social dissatisfaction.

- Efficient state apparatus which supports the military effort. Having these in mind the following remarks can be made:

In the case of the Crimean War (1853-1856) the intervention of Britain and France came eleven months after the start of the conflict but it was crucial since they both enjoyed complete superiority in armaments production, money capital available to finance the war effort, related and supporting industries at home but not at the frontline of the war. Thus both Britain and France had faced immense problems with the logistical support of the armies mainly the medical supplies and the establishment of an efficient system of hospitals and health services in the front. These difficulties however did not change the outcome of the war.

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Germany 1870-1871", Volume II, Cassell and Co. 1895, London 1895, p. 221-224 (no author provided). According to these terms only the city of Paris had to pay 200 million francs (article 11). The final peace treaty terms can be found in the same volume pages 279-281.

The Prussian-Austrian war of 1866 in spite of its limited duration had similar characteristics. The Austrian economy and especially its fiscal apparatus could not finance an extensive war. In addition the limited railway lines decreased the mobility of the army and the ability of logistical support. The fire-power artillery advantage of the Austrian guns was not adequate to influence the outcome of the war since in the infantry Prussia enjoyed superiority associated with higher financial flows, and better telecommunications and transportation systems.

In the case of the French-Prussian war (1870-1871), the Germanic confederation of states had marginal economic superiority but quickly used it for the benefit of the military machine. Thus the logistical support of the army was better the lines of communication were well established, the defence industry produced at a faster rate than the French and the tactical leadership of Moltke and the Prussian military doctrines and traditions were the main factors which triggered the victory of the 1870 war. It goes without saying that all four case studies have total war characteristics.

The lessons from 19<sup>th</sup> century conflicts apply even today in conventional warfare. In spite of the RMA doctrine and the sophistication of weapons there is no guarantee for quick victory. The economic forces continue to play a pivotal role although marginalised by most analysts which emphasize military factors such as leadership, morale, training, geographical deployment (type of territory), offensive or defensive doctrines, use of reserves etc. The above analysis demonstrates that it is not just the military factors which affect the outcome of wars but also the economic ones especially since no-one can predict the time duration of the war.

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