From Sickle to Hammer:

Frictions' Role in the Industrialization of Russia

Guillem Blasco i Piles[1]

Advisor: Federico Tadei

September 2018

Abstract

This paper studies the structural transformation of Russia in 1885-1940 from an agrarian to an industrial economy. To do so, time-series for Tsarist Russia and the Soviet Union during 1885-1940 are reconstructed and a methodology is developed that allows us to identify the different factors that had the largest quantitative impact on Russia's economic development, through the reduction of frictions in the productive process. The results of the research showed that investment was the main economic variable in diminishing the production frictions. War communism exacerbated market distortions in the production process, due to their extremist policies in extremely harsh times. During Stalin's Five-Year Plans, investment was channeled through the granted easy credit of the *Gosbank* to fund the impossible high production objectives. This set of policies seemed to have the largest impact in the reduction of the production market frictions of the analyzed period, particularly, the first Five Year Plan. At the contrary, education was not found significant in the reduction of the production frictions and, as expected, frictions remained high during the Tsarist Period, deterring industrialization.

---

[1] Universitat de Barcelona, MSc in Economics. E-mail: guillem8433@gmail.com

Gràcies mare. A Tere, Toni, Carles i Vincent.

1   Introduction

The main aim of this paper is to analyze the industrialization of Russia by finding the main obstacles that impeded its structural transformation. Actually, the most persuasive evidence regarding Russia's growth pattern was the increase of 3.3 percent per annum from 1885 to 1913 and rising investment rates. However, when the structural change is analyzed the success becomes feeble. Indeed, in 1913 the peasantry formed the seventy-five percent of the population, a modest reduction from 1860 levels. Another indicator would be the agricultural sector accounting for the 59 percent of the economy in 1885, decreasing just to one half in 1913. As a consequence, many questions arose in describing why and how Russia was a developing economy with a lethargic pace.

Traditionally, it has been argued (Murphy et al., 1989) that Russia's industrialization was the consequence of a "Big-Push" model implemented by Stalin's economic goals, known as "The Five-year plans". However, this has been proved inaccurate, due to the fact that the observed "Big Push" models showed the opposite results to what it should have been expected[2]. Moreover among others, Lenin (1894, pp. 74-75) and Gerschenkron (1965), suggested that the main impediment to development was caused by the archaic agricultural institutions (the *obshchina*)[3] in Tsarist Russia, which reduced the rural-urban mobility (labor friction), as happened in Japan before the WWII (Hayashi et al., 2008). Nonetheless, one more time this has been proved inexact.

On the other hand, many historians (Davies, 1994; Crisp, 1978) claimed that the market frictions, were the most important obstacles to economic development at the turn of the 19th century. Indeed, the historical evidence points out the role of monopoly capitalism. This friction was caused by the privileges that the manufacturing companies relished from 1895 until 1914. This fact can be observed through Tsarist Russia's corporate law, where the registration of any joint stock company required a special concession from the tsar, who personally signed the corporate charter, causing the creation of cartels (*sindikaty*)[4]. Moreover, due to the barriers of entry and the derived monopoly power, these *sindikaty* kept their production at low levels and their markups-to-marginal costs ratios at high levels in order to obtain large profits. Additionally, they were able to determine the sales quotas for their members and the wholesale prices (Davies et al., 1994, p. 2). Consequently, this monopolistic power led to an inefficient low demand for capital and labor in the manufacturing sector and a low investment in the manufacturing sector (Cheremukhin et al, 2017). Thus, Russian industrialists retained market power not only in the goods market but also in the labor market, maximizing their

---

[2] A well known formalization of the "Big Push" model predicts that industrialization should result in both a higher manufacturing TFP and a higher labor frictions.

[3] Obshchina, Rus: община. Lit. Trans.: Commune / Selskoye obshestvo, Rus: Сельское общество, Trans: Village community

[4] Sindikat, Rus: синдикат. Lit. Trans: Syndicate. It is a cartel agreement that involves the sale of its participants' products through a single sales agency set up in the form of a joint-stock company or an LLC.

profits by reducing their output below the socially optimal level. Hence, the barriers to entry and the resulting monopoly distortions in the manufacturing sector were an important reason for the "backwardness" of Russia's economy in the end of the 19th century. Cheremukhin et al. (2017) acknowledged these facts through their wedge accounting method.[5] The main logic behind this analysis lays on the tangibility of the mechanisms of the Russian economic history, where they represent themselves as deviations from the values of the optimality conditions in the model. Thus, an efficient economy could be observed if frictions in the market were nonexistent or quite low, permitting the optimal allocation of resources across sectors within the country. Nonetheless, these authors found that the Russian economy was seriously distorted. Furthermore, they discovered that these distortions were predominantly influenced by the frictions in the production process, where the marginal product of labor in the manufacturing sector was substantially higher than the workers' earnings, indicating significant markups in the non-agricultural sector for the 1885-1913 period. Hence, their discoveries expanded the support for the role of monopoly capitalism in explaining Russia's backwardness.

Alternatively, it could be also observed that the Soviet economy from 1920 to 1939 was unsuccessful, in productivity terms, in both the manufacturing and the agricultural sectors. Indeed, the total factor productivity (TPF) actually diminished by 20% during 1928-1932.[6] Nevertheless, the most interesting insight of these period is how the intersectoral frictions substantially declined, entailing into a rapid structural change and GDP growth. Yet, another interesting observation unearths from this fact: as Cheremukhin et al (2017) showed, the reduction in distortions is mostly explained by a dramatic decline in the production process frictions, where the decrease of the markup in the manufacturing sector drives the decline. Hence, again the variation in the reduction in the production component of the frictions (wedges) accounts for most of the structural change that occurred during Stalin's period, and significantly contributes to the expansion of real GDP per capita, being the role of other frictions relatively low.

Therefore, this research aims for the identification of the causes that induced the reduction of the markup and, simultaneously, the decline in the production process frictions and the increase in GDP. Hence, this will help us to understand how Russia industrialized by checking and establishing a clear connection between the traditional literature and the recent research findings. Thus, in order to proceed, this study will check econometrically how the main economic variables and the sets of policies from the different governments, that took place throughout the studied period of time (1885-1940), affected the production wedge.

---

[5] Firstly carried out by Chari et al. (2007); any set of policies can be mapped into a set of distortions, frictions or wedges, in a neoclassical growth model.

[6] Cheremukhin et al. (2013)

Moreover, a new time series has been estimated in order to proceed with this enquiry. The data for the different main analyzed economic variables have been enlarged, incorporating the missing years for the WWI, the Russian Civil War and the NEP. Thus comprising a time set from 1913 to 1928. Nevertheless, for the whole time series (1885-1940) new variables have also been constructed and modified: Literacy Rate, Inflation and Population, respectively. (See Section 6 and Appendix A).

The results of our research show that Stalin policies during the first 5-year plan, particularly the lax provision of bank credit (soft credit/budget constraints) to the heavy industry SOEs (State Owned Enterprise) along with high production objectives, permitted Russia to industrialize. Moreover, the evidence shows how War Communism expanded drastically the frictions due to the policies that were carried out. These extreme measures included forced nationalization of firms, collectivization of lands and seizing the private property. However, this must be also contextualized in the extreme times of the Russia Civil War, which worsened the situation. As expected, we find no impact of the Tsarist time, since the Production Wedge remained constant and high, deterring Industrialization. Consequently, investment in the different forms acted as the main economic variable driving the production wedge down. Contrary to the literature suggesting that education may have had an important role in the industrialization (Allen, 2003; Galor & Moav, 2006), we find no evidence in support of this claim for Russia. Thus, the results defend the previous literature main assumptions, except for education, and confirms the methodology used by Cheremukhin et al. (2017). These results allow us to better understand how policies, conflicts and different economic systems may affect the society of a country through the economy. This research also lets us observe what could occur when different policies are enforced at the same moment, one may nullify another and the result can be totally different from the desired outcome. Overall, the study of economic development provides the tools for a better understanding of the societies improvements in their context. Russia, in this line, is one of the best examples of a country with great development potential that has been constrained due to its different economic and political events.

The structure of the paper is as follows. Section 2 (Literature Review), describes the previous literature, which provides the solid bases of our study. Section 3 (Historical Overview) explains the historical context of the period where our research is based, providing an insight of the policies, historical and economic events that affected Russia from the 1885 until 1940. The four following sections constitute the core of the paper. Section 4 (Theoretical Framework), contributes to the paper by explaining the facts and logic behind our theoretical model. Section 5 (Methodology) presents the model and the main variables. Section 6 (Data) explains how the time series were constructed. In section 7 (Results), the main results are analyzed in order to compare them with historical events and the previous literature. In the last section, conclusions from our research are stated, expressing the applications for future researches.

2   Related Literature

This paper is based, in many respects, on the research performed by Cheremukhin et al. (2017). The authors observed the effects of Stalin's industrialization on economic growth in Russia using a two-sector macroeconomic model. Indeed, for our study we used the production component of the labor wedge to define our dependent variable, in order to analyze the effects that different factors had in the reduction of the market markups that facilitated Russia's rapid structural transformation. Furthermore, it should be mentioned that these authors used a wedge decomposition methodology, essential in our study, which was built on the research of Chari, Kehoe and McGrattan (2007), Hunter and Szyrmer (2014),[7] but unlike them, Cheremukhin et al. (2017) studied distortions in both quantities and prices and focused on sectoral reallocation. Additionally, our paper seems to indicate the assumption of the monopoly capitalism as main source of the distortions in the economic development during the Tsarist period due to misallocation of resources as studied by Parente and Prescott (1999) and (Alder, Lagakos, and Ohanian, 2012).[8] Furthermore, Hayashi and Prescott (2008) studied the role that labor mobility restrictions played in the structural change in Japan, depressing its economic development. However, as many academics (Allen, 2003; Cheremukhin et al., 2017;…) found the agriculture institutions during Imperial Russia were not the main detrimental factor for its economic growth.

In addition, it should be mentioned that this paper is based on the economic history works by Robert Allen (2003), Cheremukhin et al. (2013), Davies et al. (1994) and Gregory et al. (1986). Their research provided most of the academic literature that supports our established hypothesis about the economic development and frictions in Russia, as a result of their comprehensive description of the institutions and policies that were enforced. Indeed, they found that: "entry barriers and monopoly power in the non-agricultural sector were the most important reason for Tsarist Russia's failure to industrialize before WWI. On the other hand, Soviet industrial transformation after 1928 was achieved primarily by reducing such frictions, albeit coinciding with a significantly lower performance of productivity in both agricultural and non-agricultural sectors."[9] Hence, it would be crucial to declare that these academics contributed to the idea and logic behind the variables suggested in this paper, in an attempt to explore the causality on the reduction in the frictions deterring economic development. Nonetheless, the main difference between Allen (2003) and Cheremukhin et al. (2017) is that the first specified the laws of motion for various economic variables and constructed counterfactuals by changing the exogenous parameters. The others, instead, measured both theoretically and quantitatively the wedges (frictions) and estimated their impact in a general equilibrium model in which consumers make their decisions optimally, subject to those distortions. Thus, their methodology

---

[7] Similarly, these scholars evaluated Stalin's economic policies in 1928–1940 using a multi-sector and multi-period linear model.

[8] (Alder, Lagakos, and Ohanian) studied the role that monopolies and entry barriers played in the decline of the U.S. Rust Belt.

[9] As declared by Cheremukhin et al. (2017)

not only allowed to establish the inefficiency in Soviet industrialization but also how alterations in these wedges played an important role in structural transformation. Although this paper focuses on developing further what caused the most significant frictions, the production component of the labor wedge, to change. Besides, Gerschenkron (1965)[10] and Kahan (1967) also provide an insight about the agricultural and government policies implemented during the Tsarist Russia. Nevertheless, it should be mentioned that Gerschenkron (1952, 1963) and McCaffray (1993) contributed to our research with his historical research about the world's largest country. Particularly, McCaffray (1993) pictures from a wide array of sources to reveal the intellectual, cultural, and social underpinnings of Russia's early industrialization. Representing nearly sixty firms responsible for most of the south's coal and steel production, the middle-class men who ran tsarist Russia's coal and steel industry composed a substantial portion of Russia's technical *intelligentsia*.

Additionally, Banerjee & Russell (2002) contributed to the general framework with their study on how inflation influenced the markups. Likewise, Lozovsky (1920) and Gordon (1941) displayed the role, power and influence that the Worker Unions had, from tsar Nikolay II to Stalin, being an important barrier of entry in the economic theory. The role that education plays in the process of structural change is suggested by Barro (1991), Allen (2003) and Galor and Moav (2006), where the last scholars analyzed the role of education in the industrialization in England.

However, this paper builds on historical accounts and data in Allen (2003), Gregory (1986), Davies (1994), Markevich et al. (2011), Drummond (1976), Gregory & Sailors (1976) and the *Istoricheskiye Materialny*. These studies have allowed this research to estimate the lacking data, adjusting it to the historical context and obtain the needed proxies.

Thus, similarly to Allen (2003) and Cheremukhin et al. (2017) this paper finds that the investment strategy policies enforced by the Soviet government, high output targets and soft budget constraints, were the main causes for the reduction in the production process frictions.

3   Historical Overview

The aim of the following paragraphs is to provide a pithy compendium of the main events of Russian history, the essential features of the economy, and the most important policies from the reign of Nikolay II to Yosif Stalin, including the patterns of growth in Russia.

Firstly, it should be noted albeit the study in this period is concentrated between 1885 and 1940, this section will commence at 1854 in order to provide a more detailed historical panorama. As a matter of fact, the outcome of the Crimean war (1854-1856), initiated under Tsar Nikolay I and

---

[10] Alexander Gerschenkron proposed the idea of Relative Backwardness: when the gap increases between the economic potential of a nation and its' economic reality, tension is created and new institutions are substituted for missing preconditions, and a spurt of industrial growth occurs.

finished under Tsar Aleksandr II (1855-1881), offered a vision to real situation in Russia. It recognized the potential dangers of the growing inequality with the West, resulting in a resurgence of the interest in promoting industrialization (Gregory, 1982). One attempt towards this direction was the abolition of serfdom[11] in 1861, where the serfs gained the rights[12] of full citizens in exchange for redemption payments (such as government bonds). Nonetheless, the land, known as "allotment land", was given to the *obshchiny[13]* rather than transferred to private households. Actually, individual peasants would have rights to strips of land that were assigned to them under the open field system. Unfortunately, a peasant could not sell or mortgage his land, so in practice he could not renounce his rights to his land and thus he would be required to pay his share of redemption dues to the village commune. Moreover, the peasants were not given enough land to provide their needs. Hence, in words of Allen (2003): "This policy slowed economic growth by reinforcing communal ownership, preventing the emergence of a labor market, and by reducing the demand for manufactures since self-sufficient peasants bought few commodities". As a matter of fact, some researches suggested that peasants were significantly overcharged for their land.[14] Tsar Aleksandr II also proceeded with profound reforms, in an attempt to avoid depending on land aristocracy, and made an effort to foster Russia's industrial development and natural resources, by incentivizing the construction of the rail network. Indeed, under his reign, the *Imperator* assembled 984 km of railroads per year.

Nonetheless, in 1881, the Tsar was assassinated by revolutionaries. His son, Tsar Aleksandr III succeeded his father in the throne (1881-1894), initiating a reign of counter-reforms, strengthening the security police (*Okhrana[15]*), by awarding it with extraordinary powers (Gordon, 1941). In addition, the Autocrat of All the Russias reversed some of the enlightened reforms of his father, remarking his autocracy. However, some liberal financial reforms were introduced, in an attempt to ameliorate the poor living conditions of the peasantry. One of these reforms was the abolition of the Poll Tax, in order to accelerate the legal transfer of the land allotted to peasants by the abolition of serfdom. Moreover, the Royal lands became available for leasing or acquisition on favorable terms (Van der Kiste, 2003). Nonetheless, the *Imperator* also contributed to the development of the railroad network, increasing the extension built by 1154 km per annum.

From 1887 until 1892, Ivan A. Vyshnegradsky[16] was Russia's Finance Minister, pursuing a policy aimed at the balancement of the budget deficit. Indeed, Russia's Finance Minister advocated for

---

[11] 20 million of privately held serfs were involved.

[12] Such as: right to marry without having the consent, to own property and to own a business

[13] Rus: общины , plural form of the word *Obshchina*, Rus: община

[14] (Gerschenkron, 1965)

[15] 15 Rus: Охрана. Trans: Secret Police force of the Russian Empire, formed to combat terrorism and left-wing revolutionary activity.

[16] Ivan Alexeyevich Vyshnegradsky (in Rus.: Иван Алексеевич Вышнеградский), 1832, Vyshny Volochyok-1895, St. Petersburg.

a stronger intervention of the government in private railways, along with the nationalization of the least profitable companies and segments. Moreover during his ministry, Vyshnegradsky supported economically the domestic industry and prepared a monetary reform. Vyshnegradsky achieved a balanced budget by increasing direct taxes and accumulating gold reserves that strengthened the rouble, but the increase in taxes worsened the conditions for the peasantry (Stepanov, 1996). Furthermore, Vyshnegradsky established the Mendeleev tariff in 1891, which was levied on agricultural imports, channeling the gains towards the industry, the railroads and the budget by limiting the international competition of the Wheat Boom.

In 1894, Alexander III was succeeded by his son, Nikolay II, who was committed to retaining the autocracy that his father had left him. Under his reign the industrialization of Russia began to become influentially significant, however the country remained rural. Indeed, in the late 19th-early 20th century the Russian economy was much more agricultural than economies of other countries at similar stages of development (Allen, 2003). The resurgence of interest in promoting the Russian Industrialization became specially true under Count Sergey Witte[17], who was the 13th Finance Minister (1892-1903) and the First Prime Minister of the Russian Empire (1905-1906). Indeed, the railways network expanded 1942 km per annum until 1917, being built solely in 1899 and 1915 the amount of 5297 km and 5414 kilometers of railroads respectively.

This new expanding transportation network helped to internationalize the resources of the Empire. As a matter of fact, Russian growth in the late nineteenth century was caused by the combination of the railroad expansion, the increases in agricultural productivity and the integration of the world economy. Cultivation was expanded to the steppes of the south of Russia and extended into western Siberia. Nonetheless, the speed of industrialization was not fast enough to provide the structural change of the economy (von Laue, 1963). Rising prices of food offset the increase in income of the factories, railroad and, construction workers caused by the wheat boom (Allen, 2003). In addition, at the countryside the rental prices of land also rose, hence the way to benefit from the wheat boom was by land tenure, but most peasant-owned farmland in the Empire was held by the *obshchiny*. Thus, even if the peasants were doing better they were still poor. As a Finance Minister, Count Witte also followed a conservative monetary policy that stabilized the exchange rate of the rouble, allowing Russia to join the international gold standard in 1897 (Drummond, 1976), leading to an increase in investment activity and in the inflow of foreign capital. Moreover, his policies also aimed to promote the expansion of domestic heavy industry by pursuing an aggressive Import

---

[17] Count Sergey Yulyevich Witte (Rus.: Серге́й Ю́льевич Ви́тте), (29 June 1849 – 13 March 1915), was a highly influential econometrician, Finance Minister, and the First Prime minister in Imperial Russia. He became one of the key figures in the political arena at the end of 19th and at the beginning of the 20th century. He has been described as the great reforming finance minister of the 1890s, as one of Nicholas's most enlightened ministers, and the architect of Russia's new parliamentary order in 1905.

Substitution[18] [19]. This protectionist trade policy included the implementation of high protective tariffs, profit guarantees, tax reductions and exemptions. Tariffs on most industrial goods were high from the 1880s to WWI, where Russian prices exceeded world prices by a premium that remained stable for most commodities (Allen, 2003). Thus, higher prices for manufactured consumer goods contributed to stagnate real wages. In addition, the consequences of the applied policies created a very rapid rate of concentration of production. Powerful monopolies (*sindikaty*) were formed, and these trends in economic organization, in turn, had a significant, if not decisive, impact upon the direction and tempo of development. The *sindikaty* started to dominate most industries such as iron, steel, oil, coal, and railway engineering. Henceforth, the size of Russian industry at the end of the 19th century was relatively small with significant barriers to entry and widespread monopolies (Cheremukhin et al., 2017). However, by 1900 the manufacturing industry growth had been four times faster than in the preceding five-year period, and six times faster than in the decade before. In section 5.3 the big role that the *sindikaty* had in deterring Russia's structural change is further explained.

After the defeat in the Russo-Japanese War (1904-1905), an incident called as the "Bloody Sunday"[20] occurred. In response, the Russian masses were so furious over the massacre that a general strike was declared demanding a democratic republic. This historical event established the beginning of the 1905's Revolution[21]. Russia was paralyzed, and the government desperate. All political groups participated in the revolution, including the Orthodox clergy (Maureen, 1972). This first major revolution was caused (Conroy, 2006), in first place, by the poverty of the peasantry, who earned too little and were not allowed to sell or mortgage their allotted land. In second place the "Russification" policy of the government through discrimination[22]. Moreover, the nascent industrial working class opposed the government for banning strikes and labor unions (Gordon, 1941). Finally, the new ideas such as socialism, anarchism and liberalism opposed the archaic social institutions of the Empire, generating the ideological seed that would trigger the following revolutions.

In the aftermath of the Revolution, the government recognized the problems and presented some timid reforms, consisting in the creation of a consultive parliament (Imperial Duma) elected via a democratic franchise; granting of civil liberties; a cabinet government; and a 'constitutional order'.

---

[18] In 1889, he published a paper titled "National Savings and Friedrich List", which cited the economic theories from Friedrich List.

[19] Import Substitution Industrialization (ISI) is an economic and trade policy aimed to replace foreign imports with domestic production.

[20] Father Grigori Gapon led an enormous crowd to the Winter Palace in, at the time, Petrograd to present a petition to the Tsar. When the procession reached the palace, soldiers opened fire on the crowd, killing hundreds.

[21] On 9 October 1905 Witte told 'with brutal frankness' the Tsar that the country was on the verge of a catastrophic revolution, which he said 'would sweep away a thousand years of history'. He presented the Tsar with two choices: either appoint a military dictator, or agree to broad and major reforms.

[22] They were banned from serving in the Imperial Guard or Navy, voting and limited attendance in schools.

In addition, in 1906, Pyotr A. Stolypin[23] became the 3rd Prime Minister of Russia (1906—1911). Under his ministry Stolypin issued a series of decrees and undertook a new Land Reform, in an attempt to undermine the *obshchiny* by allowing individual sales of land and encouraging the peasants to convert land from communal to hereditary tenure, and to exchange their scattered strips in the village fields for consolidated and enclosed farms, facilitating the exit from the repartition communes (Castañeda & Markevich, 2013). Nonetheless, Stolypin was assassinated in 1911, and his reforms could not be implemented completely. However, Cheremukhin et al. (2017) argue that "the role of communes in Russia's agriculture should not be overestimated, since according to the Land Ownership Statistics (Central Statistical Committee of the Interior Ministry, 1907, pp. 11), in 1905, 39 percent of land was owned by the government, and 26 percent were in private ownership (i.e. owned by landlords); the communes accounted for only 35 percent of total land, or 58 percent of non-government land." Indeed, according to Allen (2003), Stolypin reforms had a noticeable effect in weakening the communes, since the proportion of peasant in communes declined from 71 percent in 1905 to 61 percent in 1915 (involving a migration of 2.5 million of peasant leaving the *obshchiny*). In addition to these results, the reforms also increased the agriculture productivity by 14 percent nationwide, 25 percent in Siberia. In fact, Russia's grain exports in 1912 exceeded by 30 percent those of Argentina, US and Canada combined. Indeed, Castañeda & Markevich (2013) found a large positive effect of land consolidations on agricultural productivity. In 1820, Russian income per head was $749 (1990 dollars), which was on a par with the less developed countries of Asia and Latin America, significantly behind western Europe. Nonetheless, it made some progress, and by 1913 its income had risen to $1488 per head. However, the West was a moving target and, on a percentage basis, Russia was farther behind in 1913 that it had been in 1820 (Cheremukhin et al., 2017). Furthermore, by 1913 railroad expansion had ran off of steam as an engine of growth. After Stolypin, Vladimir Kokovtsov became the 4th Prime Minister.

In August 1914, *Imperator* Nikolay II started the mobilization of the troops in defense of Serbia against Austria. Later on, the system of European alliances would provoke the outbreak of WWI. Military reversals and shortages among the civilian population soon soured much of the population. By the middle of 1915, agricultural output decreased drastically, since the peasants left to the front, and inflation exploded. Consequently, strikes rose among low-paid factory workers, and social unrest became common (Markevich & Harrison, 2011). Eventually, the Russian Empire was overthrown before the WWI ended. with the February Revolution in 1917. This revolution was followed by the October Revolution by the Bolsheviks, leading to the Russian Civil War. This Civil

---

[23] Pyotr Arkadyevich Stolypin (Rus.: Пётр Арка́дьевич Столы́пин) (14 April, 1862 - 18 September 1911). He became the 3rd Prime Minister of Russia and simultaneously Minister of Internal Affairs of the Russian Empire. He is considered one of the last major statesmen of Imperial Russia with clearly defined reforming policies.

conflict had an enormous effect on the country and finished in 1922 with the Communist Victory. Overall, Russia's Great War and Civil War led to economic disaster and demographic tragedy.

With the outbreak of the Russian Civil War, Russia was divided in two differentiated zones controlled by the White Army or the Red Army (*Bolsheviky*). The territory in hands of the proletarian army applied what would be known as War Communism (1917-1921). Under this economic regime, Lenin decreed the nationalization of all the land, transferring its use to the peasantry. Moreover the reforms of Stolypin were reversed and the open fields were reassembled and regained by the communes (Allen, 2003). Economic problems became particularly serious due to the Civil War, grain requisitions and the disruption of the commercial patterns reduced the incentives to sow. Consequently when nature struck, the famine of 1921 that killed millions was the result. As a consequence of the conflicts and the economic policy, the urban economy almost vanished for good. The industrial workforce fell from 2.6 millions in 1917 to 1.2 in 1920. In 1926, the peasantry accounted for the 82 percent of the Russian population in comparison to the 72 percent in 1913 (Davies, 1990). In 1919, the communist government issued a nationalization decree where large-scale firms, first, and then, small-scale and workshops were taken under state control. Later on, in 1921, the economy was torn apart, the *Bolsheviks* were in control of the whole country and hyperinflation was rampant. Davies (1990) accounted that the the grain output was 56 percent below its 1913 level, livestock 73 percent down and industrial production had dropped 70 percent. As a consequence of the hard economic times, Lenin introduced the New Economic Policy[24] (1921-1928). In this new economic approach the Soviets changed the requisitioning of food for moderate taxation, factory industry was put on commercial basis and organized as profit-maximizing trusts, private trade was legalized, and economic exchanges between peasants, urban residents, and industry were conducted as market transactions (Allen, 2003). In addition a monetary reform was introduced where the *chervonets* were introduced, a new currency backed by the gold standard, bringing stability a effectively cutting the rampant hyperinflation (Drummond, 1976). Industry and agriculture recovered and, at the end of the 1920's, output was at its 1913 level. Nevertheless, the renewed communes of the NEP (communists saw communal property with good eyes) had the capacity to constrain farm size growth by limiting the capacity to achieve economies of scale and achieving a mechanization of the Russia fields.[25]

In 1924, Lenin died and a battle for the power arose. Yosif Stalin, Kamenev and Zinoviev took the control of the Communist party against the party's left-wing, led by Leon Trotsky, right-wing, led by Bukharin and the own members of the triumvirate (Kamenev and Zinoviev). In 1928, Yosif Stalin replaced the NEP for a centralized planned economy applied through 5-Year Economic Plans, that

---

[24] NEP , *Novaya Ekonomichyeskaya Politika* (Rus.: Новая экономическая политика). Economic system proposed by Vladimir Lenin following Karl Marx's precepts that a nation must first reach "full maturation of capitalism as the precondition for socialist realization.

[25] "This has been a common pattern in developing countries during their Green Revolution and it would have been the fate for the Russian farmers had the 1917 revolution not overturned the Stolypin reforms " (Allen, 2003).

dictated the economic strategy that the country's economy had to follow. The institution in charge of carrying out the application of the economic objectives was the *Gosplan*.

In fact, during the first three 5-Year Plans (1928-1940), economic development was quite rapid, industrial output increased 11% per year and GDP grew at a 5.3 percent per annum (Allen, 2003). Indeed, during the pre-WWII Stalinism, a Prices Scissors Policy was enforced. This policy consisted in giving grain procurement quotas below market prices and selling them at the city above market prices in order to fund the heavy-industry investment (Allen, 2003). The burden fell on the back of the more prosperous peasants, the *kulaks*. At the beginning of the 1930s, Stalin sought to prohibit private markets of agriculture products and to socialize the livestock. Moreover, all members of the peasantry were forced to join the recent formed Kolkhoz (collective farms).[26] This policy was known as Collectivization, and provoked the agricultural production to plummet (Gregory, 1982). Creating, as a consequence, the harsh famine of 1932-1933. The famine and the reduction in agricultural income inflow also caused a massive migration from the countryside to the city. However it should be mentioned that the levels of production, in per capita terms, were still higher than the levels of the 19th century (Allen, 2003). Since total agricultural output exceeded subsistence needs, the increase in mortality could be avoided. In addition to the agrarian collectivization, industrialization through the investment of the heavy-industry and manufacturing production was sought. During the 5-Year Plans, the government nationalized trade and introduced price control (Cheremukhin et al., 2013). Particularly, each 5-Year plan dealt with all aspects of development, although the emphasis varied from plan to plan, generally, the main focus resided on energy, capital goods, and agriculture. It should be important to notice the importance of the abundant credit from the *Gosbank*, since Soviet SOEs had the objective to maximize output rather than profits (this topic is further analyzed in section 5.3). As a matter of fact, the production objectives were rarely met, but provided the base for the industrialization of the USSR through labor-hiring. Indeed, the theoretical framework developed by Cheremukhin et al. (2017) acknowledges this historical events as the following section will explain, being a useful mechanism for the study of frictions in economic history and growth.

4   Theoretical Framework

In this section, the framework that gives logic to our model and research will be explained. First, it should be stated that a distortion is any departure from the ideal of perfect competition, which therefore interferes with economic agents. In equilibrium, with perfect competition and no externalities, there is no distortion in the supply and demand, thus price would equal marginal cost for

---

[26] The dekulakization campaign of 1929-1931 affected around six million peasants where the most prosperous and learned peasants were expropriated, exiled to Siberia or executed (Davies et al., 1994, p. 68).

each firm and product. In the opposite case, the reallocation of resources across sectors may be slowed by frictions which in turn may be affected by institutions and policies.

Indeed, the wedge accounting methodology allows us to identify the types of frictions and economic mechanisms that have the largest quantitative impact on the Tsarist and Soviet economic development during the studied period. The main identity in the wedge accounting methodology is (Cheremukhin et al., 2017):

$$\frac{(U_M F_M)}{(U_A F_A)} = \frac{(U_M/p_M)}{(U_A/p_A)} \frac{(p_M F_M/w_M)}{(p_A F_A/w_A)} \frac{w_M}{w_A} \tag{1}$$

where U is the marginal utility for agriculture (U_A) or manufacturing (U_M), F is the marginal products of labor in the two sectors and p_M/p_A and w_M/w_A are the relative prices and wages. Thus, as previously stated, in perfect competition and the absence of frictions, or distortions, the three components on the right hand side would be equal to one. The first term of the right hand side corresponds to the consumption component. This term captures the frictions in consumer markets, such as poor integration of product markets. On the other hand, the frictions in the production process, due to the existence of monopoly power or barriers to entry, lays in the middle of the right hand side of the equation. Finally, the term composed by the relative wages corresponds to the mobility component. This term maps the distortions in the labor market, such as costly human capital acquisition or barriers to labor mobility (i.e.: *obshchiny*). Cheremukhin et al. (2017) determined that, for this decomposition in Russia between the period 1885-1940 (logically, the same studied period), the main driver of the wedges was the production component, and not the the other intersectoral mobility or consumption components. Moreover, they demonstrated that the reduction in the production component accounts for the majority of the industrialization that happened during Stalin's rule.

Later on, the authors built on the Herrendorf, Rogerson, and Valentiyi (2013)'s neoclassical growth model three wedges corresponding to the three optimality conditions on the intersectoral and intertemporal allocation of resources. Being the intersectoral labor wedge:

$$1 + t_{W,t} = \frac{U_{M,t}}{U_{A,t}} \frac{F_{M,t}}{F_{A,t}} \tag{2}$$

where term $t_{W,t}$ is the wedge accounting for the deviations of labor between sectors (measuring structural change through frictions between the two sectors of the economy). However, this definition depended only on quantities and the wedges can be further decomposed in prices, where p_i is the price of a good fabricated in a determined sector i, and w_i is the wage earned in a sector i. The sector i can either be Agriculture or Manufacturing. Hence, (2) can be rewritten as a product of the three terms in (1):

$$1 + t_{W,t} = \frac{(U_{M,t}/p_{M,t})}{(U_{A,t}/p_{A,t})} \frac{(p_{M,t}F_{M,t}/w_{M,t})}{(p_{A,t}F_{A,t}/w_{A,t})} \frac{w_{M,t}}{w_{A,t}} \tag{3}$$

As previously, the first component on the right hand side is the optimality condition of consumers and the term composed by relative wages is the mobility component. The component in the middle of the right hand side of the equation is the production component in the optimality condition of competitive price-taking firms. The Production Wedge, represents the market frictions in the production process. When the values of the wedges are not equal to one, is a symptom of economic policies or institutions preventing an efficient allocation of resources or economic structure that does not work as in a prototype growth model. The production wedge was the most significant one, accounting for the 70% of the labor wedge variability in the work of Cheremukhin et al. (2017).

As stated before, this method allowed Cheremukhin et al. (2017) to analyze the source of the barriers that impeded the structural transformation of Russia. Particularly, the authors attempted to explain the effect of monopoly capitalism. Consequently, they assumed that each company in the manufacturing sector was price-taker in the goods market and a monopsonist in a local labor market. As a result, the labor supply in the equilibrium N(w), that the monopsonist faces when setting wage w, is determined by free labor mobility condition between the two sectors of the economy and decreasing returns to scale in agriculture. Hence, this relationship is given by:

$$w = w_A = p_A \alpha_A (1 - N)^{(\alpha_A - 1)} \tag{4}$$

Where α_A is the share of labor in the agricultural sector and N is is the labor supply in equilibrium. Hence, a monopsonist chooses the wage rate w, in order to maximize its profit taking the labor supply equation as given, $p_M \cdot N(w) - w \cdot N(w)$. Consequently, the production wedge, or the production component of the labor wedge is:

$$\frac{(p_M F_M / w_M)}{(p_A F_A / w_A)} = 1 + (1 - \alpha_A) \frac{N_M}{(1 - N_M)} > 1 \tag{5}$$

This equation is a measure of the monopoly power, or the markup over the monopsonist's marginal cost. Consequently, this will allow us to observe the evolution of the friction over time and through some estimations discover which factor, and policies contributed to diminish it.

Hence, given this model, we are able to estimate, through a econometric regression, which were the main causes that influenced the production wedge throughout the studied period. In the next section of this research, the procedure will be explained along with the considered main variables. In order to determine the policies and causes determining the structural change in Russia.

5   Methodology

In this section, the empirical strategy will be explained along with the different main variables that may have an impact on the Production Wedge (frictions). In this way, this section will provide a better

understanding of the proposed study and of how the elected variables may affect the frictions that deterred Industrialization in Russia during Tsarism and, permitted it during Stalin's rule.

5.1 Empirical Strategy

This part will allow us to identify the main variables, policies and governments that have the greater impact on the Production Wedge. In order to do so, we specified a linear model in which the main variables that may have any influence are incorporated. The model is as follows:

Proposed Relationship:

$$PWedge_t = f(Investment, Inflation, Education, Trade, Policies) \qquad (6)$$

Initial Model:

$$PWedge_t = \beta_{0,t} + \beta_{1,t}Inv_t + \beta_{2,t}logInfl_t + \beta_{3,t}DemCon_t + \beta_{4,t}LitRate_t + \beta_{5,t}ManImp_t$$

$$+\beta_{6,t}PolicyVariables_t + \beta_{7,t}DynasticVariables_t \qquad (7)$$

The dependent variable and the main independent variables are further explained in this section. However, the Policy Variables and the Dynastic variables will be explained in this subsection, in order to understand the empirical strategy that will be conducted in this research.

The dynastic variables are *dummy* variables to control for the different governments throughout the the studied period and analyze the direct specific effects of those determined years. Consequently, four big periods will be analyzed. TsarismDD, WarCommunism and NEPDD and StalinDD will be the variables created to control for these effects (DD stands for Dynastic *Dummy*). Where TsarismDD will comprise the years 1885-1916, WarCommunismDD from 1917-1922, NEPDD from 1922 until 1928 and, finally, StalinDD will control for 1929-1940. Hence, once the most significant periods are found they will be decomposed, into smaller time packs to acknowledge the role of the different governments and sets of policies, which were implemented in specific years. For example, if TsarismDD happens to be significant, it will be substituted by VyshnegradskyGov (government of Vyshnegradsky), WitteGov (government of Witte), and StolypinGov (government of Stolypin), in order to observe more precisely the significance. Again these are *dummies* variables created for the specific years of the different governments. On the other hand, StalinDD would, at the same time, be divided among the three different five-year plans that were conducted consecutively between 1929 and 1940. War Communism and the NEP would not be further decomposed since the periods are already small enough.

The policy variables refer to a set of variables that try to identify specific effects in determined years. For example, if we want to observe the effect of Protectionism, we would incorporate to the model the new variable TsarTrade, which has been constructed by multiplying the *dummy* of TsarismDD by the main variable of ManImp (Manufacturing Imports). Consequently, we would

observe the effect of the evolution of the manufactured imports that were under the Import Substitution Policy or high tariffs common throughout the period of the Russian Empire under study.

Thus, with this combination, the model will be able to identify the source of the impact towards the reduction of the production market frictions and consequently it would construct a bridge between the Economic History literature and Economic Growth Theory.


5.2 Production Wedge

The Production Wedge represents market frictions in the production process. Consequently, it allows us to observe how the policies permitted or deterred industrialization due to the existence of barriers of entry in the market or monopoly power. During the Russian Empire the frictions to the allocation of production factors between sectors were very high. The production component of the labor wedge accounted for half of the overall wedge.[27] Consequently, this would mean that during the Russian Empire there was a severe underutilization of labor in the non-agricultural sector. It should be mentioned that the optimal value of a wedge should be 1, i.e. what it would be in the absence of frictions. However, the mean between 1885-1917 is 3.29, indicating a highly distorted system. Nevertheless, it is possible to observe differences during the different governments for the whole period. As a consequence, an interesting insight arises: the Government of Sergei Witte had on average the higher values of distortion (with Stolypin really close) of the whole analyzed Tsarist period and Vyshnegradsky the lowest. Nonetheless, none of these averaged values was below 3, indicating overall a huge impediment in the industrialization of Russia. These facts are consistent with the literature regarding monopoly capitalism, the *sindikaty,* and the administrative barriers to create and manage independently companies and firms. Hence, it can explain the low share of manufacturing production in the Russian Empire. In addition, Cheremukhin et al. (2017) state that the total wage bill was less than 20 per cent of the total factory value added, since Gregory (1982) reported: "the added value in factories was three billion rubles of 1913; factories employed two million people and factory surveys during the Tsarist period showed that the average annual wage in factories was 257 rubles in 1913."

During the War period, the production wedges increased drastically due to the official decrees to mobilize the production towards guns and weapons and the destruction caused by the war. Another important factor would be the effect of War Communism, in which collectivization, nationalization and expropriation were the most common traits. Later on, during the NEP, the production wedges started to trend down in a glacial pace, although they were still peaks. Consequently this resulted in substantial drops in total factor productivity in both the manufacturing and the agricultural sector. In this peaking period, could also be incorporated the first years of Stalins industrialization plans. The logic laying behind would be the hectic and violent imposition of expropriation to the peasants

---

[27] Cheremukhin et al (2017).

through the initial years of Collectivization of land along with the Price Scissors Policy. These policies resulted, overall, in a substantial decrease in agricultural productivity, and consequently in a famine (Holodomor). Nevertheless, during this time the production frictions started to diminish rapidly, reaching in 1930-1931 the lowest value since 1885 (in the middle of the first five-year plan). In 1935, the wages had stabilized around the value 1.21. "This meant that the Agricultural TFP and Manufacturing TFP increased back to the long-run trends, but manufacturing laid considerably beneath the trend." Cheremukhin et al. (2017).

Graph 1: Production Wedge Evolution (1885-1940)
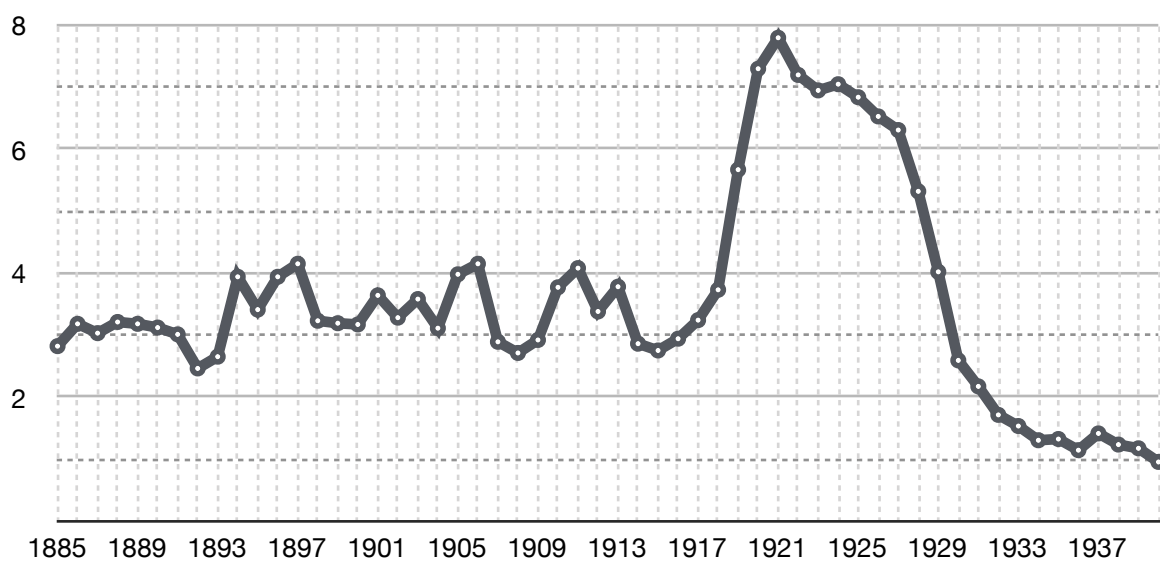
5.3 Investment

In the Tsarist period, firms operated under a capitalist logic, meaning that firms attempted to maximize profits and reduce costs. Nonetheless, at that time, Russia had an incipient private sector in which development was mainly induced by state promotion and direction. Indeed the state provided the demand for manufactured products through its railroad expansion agenda. Gerschenkron (1965) stated: "Russia was not so much demand-constrained, and therefore, in need of a substitute market as it was constrained by institutions and policies." An example of this statement would be the restraints on ownership and activities that were imposed on the charters granted, meaning that the fate of the firms would depend significantly on the state support. This fate was even more sealed, due to the fact that international markets were not excessively developed to grant the investment that the Russian companies needed. Furthermore, when Sergei Witte pegged the ruble to the gold standard, the implemented Import Substitution Policy impeded further a better funding. As a matter of fact Allen (2003) brought an interesting insight by stating: "Imperial Policy was not based on the public interest. Instead the state manipulated private firms to such degree that the possibility of spontaneous growth

was frustrated." Economic historians and Institutional Economists have proven and emphasized the role that well-defined property rights along with a stable legal environment may play in promoting investment and, as a direct consequence, capitalist economic growth. It may also be said that these characteristics during this period of Russia were not a mere result of fortune, but a direct ideological intervention due to an intense and long-standing anticapitalist and pro-autocracy ideas of the *Imperator*. This prejudice against capitalism frustrated the entrepreneurship that typically emerges from a Western commercial society. It would be also important to mention that Sergei Witte sought the industrialization of Russia, however it was Stolypin who attempted to modernize it before being assassinated. Hence as Cheremukhin et al. (2017) argued this monopolistic power led to an inefficient low demand for capital and labor in the manufacturing sector and a low investment in the manufacturing sector. Even though, Russia's main characteristic was the improving investment rate (a typical developing country trait) throughout the Tsarist era. This increase was aimed to expand the railroad in order to provide the grain to the world. Wheat was the engine of growth of Russia during that time. However, the manufacturing sector had no incentives to expand and hire new labor since they enjoyed granted subsidized profits from the state, *sindikaty*.

Later on, due to the WWI, regions that were already industrialized, like Poland or Finland, gained their independence and separated from the Empire, diminishing the industrialized zones that the Russian Empire had.[28] In addition, the war devastated the border regions of European Russia, which were at the same time the most economically developed. Nonetheless it should be said that before the devastation, investment moved towards guns and weapons drastically. The situation worsened due to the Russian Civil War, which affected every inhabited province of the Empire. The outcome was disastrous, and even more profound when the victors, the *Bolsheviky,* applied War Communism. The investment during that time returned to levels previous to 1905. Indeed, in 1920, the USSR was a traditional underdeveloped country (Allen, 2003). However in 1921 with the introduction of the NEP, whilst large-scale industry remained under direct control of the government, small-scale was allowed to be in private ownership. The NEP sought investment in machinery to improve productivity, and it also resulted in experts from different industrial fields being called upon to advice on efficiency and improvements. Indeed in 1928, investment returned to prewar levels. However the NEP SOEs operated on commercial basis, what did not allow "socially profitable" (not economic efficient) investments. As a matter of fact, this changed under Yosif Stalin's rule. Stalin's system of economic organization had two advantages in comparison to capitalist-operated firms. First, in deciding on investments, capitalist firms analyzed their own profits and ignored the externalities that their activity and investments had for other firms in the economy if they did not benefit them too (companies main objective is to maximize their profits). Hence, socially profitable investments would

---

[28] Nonetheless, they have not been taken into account in our analysis since they distorted the effects of the war.

not be undertaken. Second, following the previous logic, capitalist companies would solely hire new workers if they would generate revenue enough to cover their salaries, that is when the marginal product was greater than their marginal cost or wage. Nonetheless, in the Soviet Union output could be augmented by contracting new workers with positive marginal product even if it was less than the wage (or the marginal cost). Thus, the state-owned enterprises main objective would be to maximize output rather than profits (imposed during the 5-year plans by the production objectives), resulting in through-employment expansion growth, but at really inefficient rates and outputs. In fact, the system was funded by the *Gosbank*. It offered really abundant credit, that the SOE borrowed since they had soft-budget constraints (contrary to restraining budget constraints) in order to achieve the ambitious production objectives settled by the *Gosplan*. Hence the SOE expanded production through investment, but, as the TPFs[29] shown, at a very inefficient rate.

Graph 2: Investment, in million of rubles. (1885-1940)
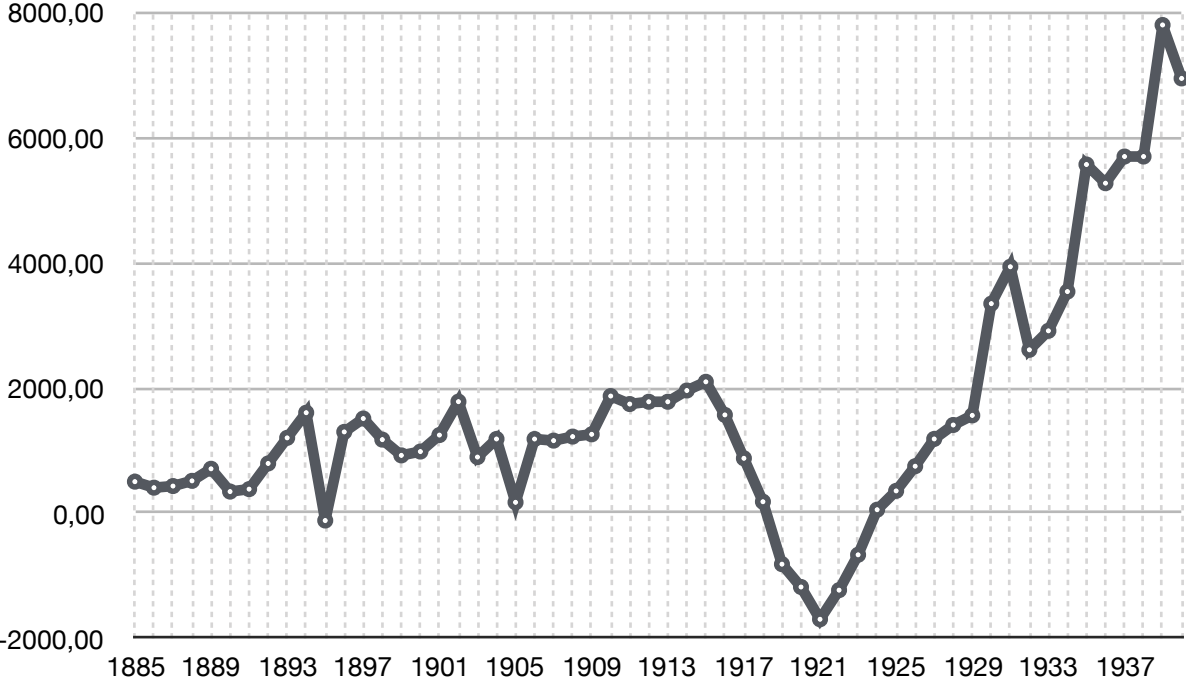
5.4 Inflation

Price changes, or the lack thereof, were an important factor in determining living standards and influencing politics throughout the history of the Soviet Union. Indeed, the Soviet Union was created and dissolved in the midst of high inflation. In the first case, the Bolsheviks took over after high food prices helped bring down the Tsarist and Republican governments. However, their initial policies led to Russia's first hyperinflation and domestic unrest, so they had to stabilize the ruble and the economy in order to remain in power. After Stalin took charge, the Soviet economy struggled with inflation for

---

[29] Cheremukhin et al. (2017)

two decades, until the 1947 currency reform finally established a monetary system based on fixed prices. Although price controls prevented inflation, they also created persistent shortages of food and consumer goods, which were the most common complaints about the economy by Soviet citizens (Efremov, 2012).

The Russian monetary and fiscal policy during the last decade of the nineteenth century made a positive contribution to the industrialization of the country, since Russia's currency was pegged to the Gold Standard from 1897 to 1913. This exchange rate imposed costs since it obliged the state to use resources for the provision of gold coin, gold reserves, and relatively low-yielding reserves of foreign exchange. On the other hand, by adopting the gold standard the state may had improved the connections between the Russian and Western capital markets, allowing Russian governments and private borrowers to obtain funds more plentifully, more cheaply, or both (Drummond, 1976). International comparisons for the year 1913 reveal that domestic savings proportions in Russia were quite high for a low per capita incomes country (over 9 percent of the net national product, NNP). Indeed, only wealthy nations as Germany, U.K., and U.S. had higher domestic savings proportions than Russia. Actually, the German and the U.S. investment rates were the only ones that exceeded those of Russia in 1913. Whether these high domestic and foreign savings rates can be attributed to the Witte System cannot be determined with certainty, however, in the absence of an alternative viable explanation, the probability is relatively high (Gregory & Sailors, 1976).

Inflation first started in the Russian Empire during the First World War and led to higher food prices in the cities, which were major factor in creating urban discontent and bringing down both the imperial and republican governments. However, when the Bolsheviks took over, they made living conditions even worse by trying to create a moneyless economy. This attempt, known as War Communism, created hyperinflation, a major famine, shortages of goods, and rebellions by peasants and sailors. The hyperinflation connoted a seven-year period of uncontrollable spiraling inflation until the reestablishment of the gold standard with the introduction of the *chervonets*, where they managed to stabilize the ruble, also by balancing their budget. The economy made an astounding recovery in the 1920s under the New Economic Policy, but industrial prices rose much faster than agricultural prices in the open market. As a consequence, the Bolshevik leaders responded by crowding out private merchants and re-imposing price controls. They also continued the Price Scissors policy, which consisted in purchasing grain from the peasants at artificially low rates and selling it at a higher ones. These factors inspired the decision to proceed with full-scale state industrialization and collectivization. During the Stalin years, the Russian economy had different types of stores with varying degrees of price controls and inflation. Strict price controls were in place in most state stores and co-operatives, while others were allowed to sell at higher regulated rates. While these stores had low prices, they also suffered shortages and a poor selection of products. In contrast, collective farm markets were completely free to set their prices according to market forces, but their prices were

usually much higher. As mentioned before, it would not be until 1944 when inflation started to decline after the Soviet government balanced its budget, and it was completely eliminated after the currency reform of 1947.

Graph 3: Inflation, currency in circulation (1885-1940)
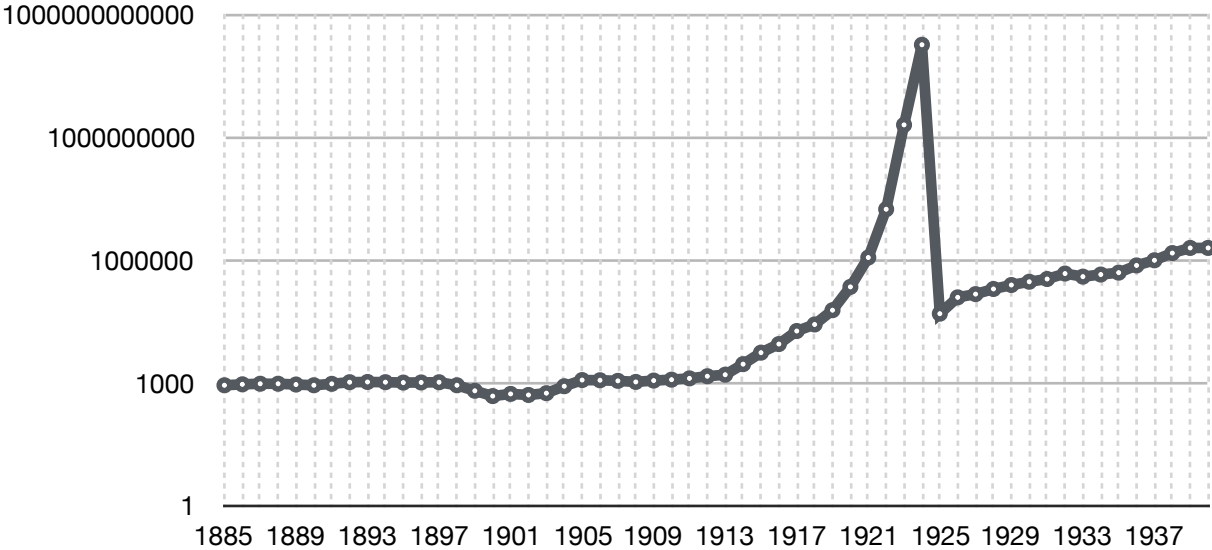

5.5 Demographic Shocks

Demographic shocks created by famines or wars have been common throughout the history of Russia, sometimes these features have led to economic instability, social unrest and political crisis. Generally, these periods of extreme violence, aggression, destruction and mortality have huge implications for the country's society and, as a consequence, for the economy. It is well known that there is a relationship between the population and the economic growth (Peterson et al., 2017). A war can strike against the most prepared people of a country, or it can make an economic or social system collapse. Moreover, it can also affect the different sectors of an economy creating a scarcity of labour supply. Indeed, in 1891-1892, during the last years of Vyshnegradsky's government, a famine occurred starting in the Volga river. This famine caused 425,000 deaths, reduced the production of cereals, and induced into a negative budget balance. Moreover, the famine reactivated the populists and marxists. This social unrest blooming can be traced back to the public's anger at the Tsarist government's management.

Later on, the tumultuous and agonizing transformation of the Russian Empire and the USSR on the first half of 1900s brought about dramatic changes in the structure of the economy. In 1905, a wave of massive political and social unrest spread through the Russian Empire. This Revolution was the first big political revolution in the Russian Empire, and the precedent of the 1917 one, consequently it would be expected to observe distorted output and influenced market frictions through the restriction of food availability (relative wages).

In 1917, the February and the October Revolutions succeeded each other. As a consequence, the Russian Empire ceased to exist, and in 1922 the Soviet Union was formed from the Empire's rubles. As Markevich & Harrison (2011) stated: "Wars and revolutions have the capacity to wreak havoc on modern societies. Nesting one inside the other, Russia's Great War and Civil War led to economic disaster and demographic tragedy." In fact, the scale of losses translated into the worst economic disaster until the moment. The deaths amounted to around sixteen million and the civil war caused many skilled people to flee the lands of the former empire. There was a superabundance of unskilled laborers but shortages of most kinds of skilled laborers. However, the Russian economy suffered less in the Great War than in the Civil War (Markevich & Harrison, 2011). War deaths and economic devastation persisted into peacetime, and were not fully restored under the New Economic Policy. Simultaneously, in 1921-1922, as a result of the economic disturbance of the War communism, the Povolzhye Famine, which killed 5 million of people, occurred.

The second biggest demographic shock emerged as a consequence of the famine (*Holodomor*)[30] and the repression (Great Purge) under the rule of Yosif Stalin. Their origin was the forced industrialization carried out during the First Year-Plan in which the collectivization of agriculture was carried out. Davies et al. (1994) concluded that "the total number of the excess deaths may have amounted to 8.5 million in 1927-36 […] most of the deaths took place during the 1933 famine." Moreover, Meng et al. (2014) gathered important evidence on the causes of famine in another centrally-planned economy, China, for the 1959-61 period. The two famines share a lot of similarities. In the two situations, there was enough food to avoid unnourishment. However, in both cases the policies of the Governments led to scarcity in the countryside. The scholars concluded that: "the similarity of institutions and outcomes in the two economies suggests that similar mechanisms are likely to have led to high mortality rates in Soviet Russia in 1931-33."

Graph 4: Population, in thousands (1885-1940)

---
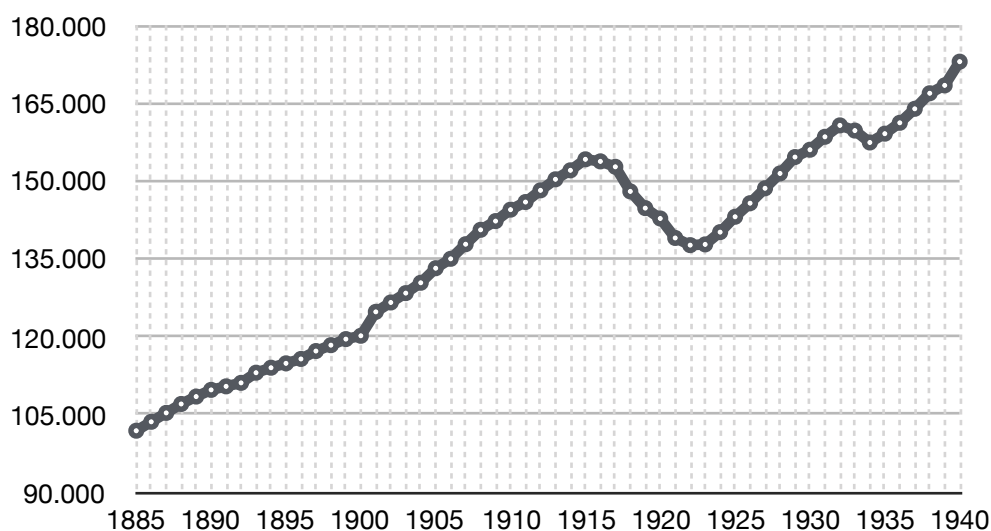
[30] Ukr.: Голодомо́р, derived from морити голодом, *moriti golodom*. (Trans.:"to kill by starvation")

5.6 Education

Many recent studies have emphasized the importance of education as a determinant of economic growth in the twentieth century (Galor & Moav, 2004; Peterson & Wesley, 2017). For example, one of the reasons why Latin America did not grow as rapidly as North America and Europe was the low literacy and education. Indeed, in 1913, the literacy rate in Russia was 39%, ranking ahead of the least developed Asiatic countries, but close to the last of the Latin American countries and far less than the developed countries (Russia 39%, Argentina 64%, Brazil 35%, US 90%)[31]. It should be mentioned, that a great advance had been made since 1886, were just the 21% was literate. Nevertheless, the difference was still considerable. Moreover, as Galor and Moav (2004) stated, "capital accumulation in the process of industrialization gradually intensified the relative scarcity of skilled labour and generated an incentive for human capital accumulation." Consequently, as the literacy rates increased in Russia due to the reforms under the reign of Nikolay II or the *Likbez* program[32] of Lenin a higher demand for skilled labor would have been observed, through the relative wages, and consequently gradual industrialization by hiring new workers. However, it is expected that the frictions during Tsarism of monopoly capitalism stopped this phenomena to happen and in the Soviet Union the firms would not follow the capitalistic logic, and worker's positions would be assigned by the *Gosplan*.

Graph 5: Literacy Rate, proportion of the total population (1885-1940)
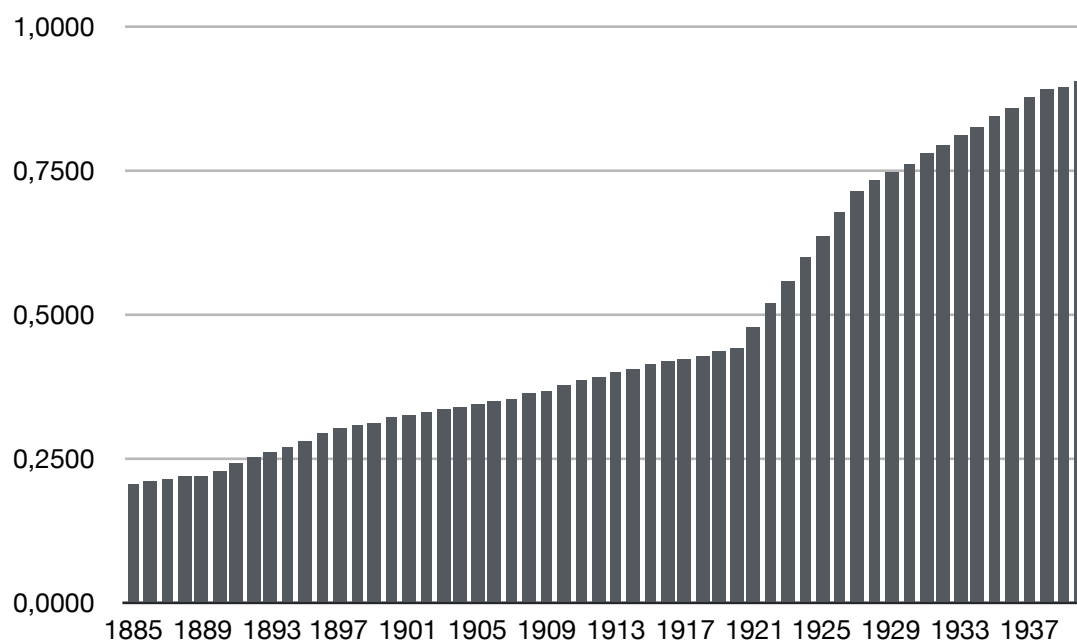
[31] UNESCO; 1953, p.55; 1957, pp. 86, 50; 1975, pp. 89, 108, 121. ; Brooks (1982).

[32] Trans: Elimination of Illiteracy, Abbreviation from *Likvidatsiya Bezgramotnosti*, in Rus.: ликвида́ция безгра́мотности. Abbr. in Rus.: ликбе́з. This program consisted in a campaign of eradication of illiteracy in the Soviet Union between 1920 and 1930, by compelling people from 8 to 50 years old to be illiterate in their mother tongue.

5.7 Tsarist Trade, Tariffs and Manufacturing Imports

Under the reign of Nikolay II, Sergei Witte started a trade policy of Import Substitution in 1891. Tariffs were levied on manufactured imports in an attempt to grant that the Russian industry would "smelt the iron ore, roll the rails, and forge the locomotives for the country" (Allen, 2003). Indeed, they channeled the demand for railroads and locomotives to Russian producers. Industrial output shifted with producer goods comprising an unusually large share of the total, particularly the outcome was a ninefold increment in the output of heavy industry. However, another circumstances emerged with the textiles, protectionism was also applied at the raw material stage (raw cotton, iron ore...) and the higher prices for the manufactured goods languished real wages. Indeed, as a result of this system, where Russian companies were protected also from external competition (in addition to the *sindikaty's* treats of favor), Russia closed itself in its domestic market. The future did not seem promising since the wheat boom was running out of steam. Indeed, the tariffs were called by Laue (1974) as "monster tariffs". This name was given due to the high rate that they had from 1880, since Russian prices were superior to world prices by a premium that remained for most goods until the WWI. Cheremukhin et al (2017) argue that: "The impact was substantial: while terms of trade improved for agriculture by about 30 percent in 1890-1913, due to tariffs retail non-agricultural prices rose so much that relative food/non-food retail prices did not change". It should be mentioned that during the time of the Soviet Union, the government always held the monopoly on all foreign trade activity until Yosif Stalin's death in 1953. The *Bolshevik* ideology opposed to external economic control and they refused to pay WWI's debts. As a consequence, trade was kept at the minimum required level. However, during the NEP, the regime permitted other organizations to deal directly with foreign partners. Nonetheless, with the first five-year plan trade was restricted once again (Socialism in One Country) to the essential, factory equipment for the industrialization.

Graph 6: Manufactured Imports (1885-1940)
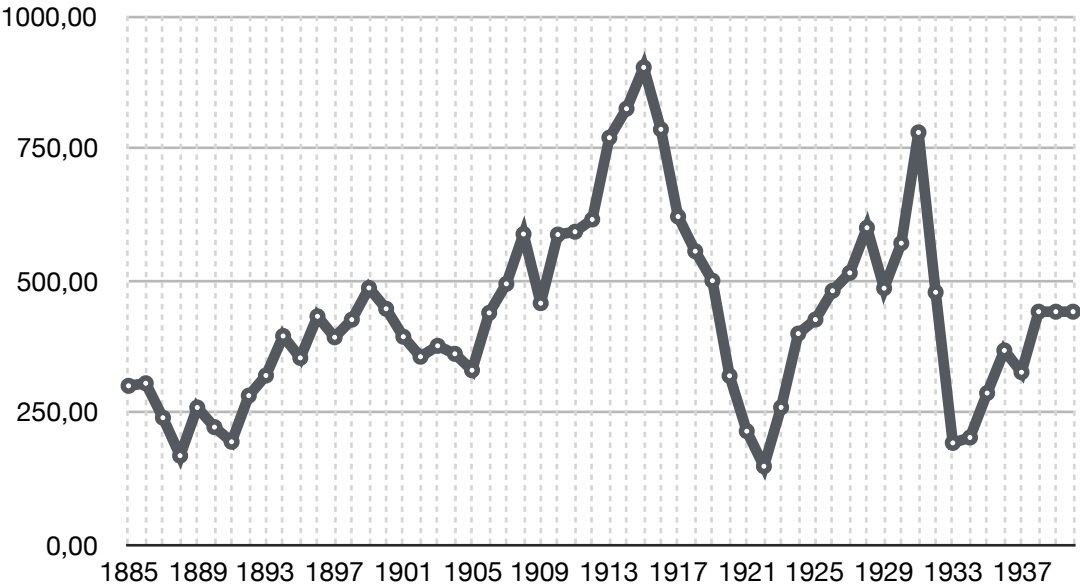
5.8 Unions

In Russia, as in every other country, the labor movement appeared with the development of capitalism. Pioneering strikes in Russia erupted between 1870 and 1880. However, until 1905's Revolution there were no labor unions in Russia. There were societies of mutual aid, but not very numerous and their activities were limited by the police laws, having no influence on the labor conditions. Only in 1905 unions were organized, and they spread rapidly on the large toiling masses, and one year after there were 200,000 organized workers in Russia. Reiteratively, from 1907 until 1914, the recently stablished unions fail to led any social pressure as a consequence of the political persecutions by the *Okhrana*. As a matter of fact, in the eve of the Revolution in 1917, in Russia, there were only three unions with a total membership of 1500 associates. On the morrow of the revolution, a strong factory committee movement had sprung up, from workers occupying workplaces or forcing their bosses into compliance with demands as the government would no longer protect them. However, as the *Bolsheviky* seized and consolidated power, this movement was dismantled by the nationalization of industries. Moreover, when the War Communism was stablished during the Russian Civil War, the trade unions ended up becoming governmental organizations whose objectives were to further the goals of management and production. They were converted to vertical unions, involving cooperation with the employer (the Government) under the central organization, Soviet of the All-Russian Unions. During the 1930s (Stalin's era), the trade unions were not permitted to challenge the Party nor the Government in any substantial way. Hence the Soviet unions did not fight for the economics interests of the workers, they rather acted as courier belts of the Party instructions, carrying punishments and rewards to industrial and collective farm employees. Moreover the strikes were illegal, protecting the State monopoly's power. As a consequence, we decided not to add the Unions variable into our regression. It is well-known that Unions interact with, and affect the markets mark-ups intensively. Nonetheless, for this particular case it resulted in a non-significant determinant as stablished in the historical literature.

6   Data

In this section, the construction of the data will be briefly discussed. See Appendix A for a comprehensive description of the data resources and construction. For this research a new sequence of time series data has been elaborated, in order to proceed with this analysis. The main source of our main variables economic data is Cheremukhin et al. (2017). They obtained, at the same time, the data for output, consumption and investment for Russia in 1885-1913 from Gregory (1982). Gregory's data, which was sufficiently disaggregated, allowed Cheremukhin et al. (2017) to build the investment time series in the manufacturing sector that it is used in our study. On the other hand they took the majority of their Soviet economic data from Moorsteen and Powell (1966), which is widely used by historians.

Moreover, for the missing data in the war years, Markevich and Harrison (2013) provided a valuable reconstruction of the data that has been also used in this research, such as investment, population, and the industry output (later used as an instrument for the IV regression). The data on inflation was extracted from the researches of Drummond (1976), Efremov (2012) and, Gregory & Sailors (1976). We used the amount of currency in circulation as a proxy for inflation, since the levels of the velocity of money and backwardness in the development of financial markets in Russia offered a good substitute. In addition, for the Education, the literacy rate seemed a good proxy to determine the level of education in Russia, since following the insights of Galor and Moav (2008), the fact of being able to read already made the difference due to the fact that they were able to understand the instructions of the machines. It should be also said that we subtracted the population of Finland and Poland from the population of the Russian Empire, in order to minimize the impact of the war that was not caused by casualties and destruction. Indeed, in order to accomplish this feat, we also computed the population of Poland under the Russian Empire from 1885 until 1918. Hence, we further complete the existing time series regarding the period from 1885 to 1940, by incorporating the values of the missing years for WWI, the Russian Civil War and the NEP. Cheremukhin et al. (2017) stated that this missing period of time was of particular importance for the scholars analyzing Russia's history. Regarding the precision of the soviet figures, several studies (Allen, 2003; Davies et al., 1994) have concluded that the majority of these figures were reliable. However, in order to improve precision we obtained the majority of our data from previous research. Moreover we also interpolated, and reconstructed part of the data from many different studies guidelines and from the IstMat (*Istoricheskiye Materialni*)[33] and the Russian Statistics Library. This allowed us to estimate the values of the Production Wedge for the missing years. In addition, we tested out that the estimated an interpolated data in our research matched the historical accounts, tendencies and events. For example, the estimations for the production evolution during the War Period were checked with the statistical book of Kafengaus (1994) with a satisfactory outcome. Hence in the following section, we will use the completed time series to analyze the effects on the frictions over time.

7   Results

In this section, the results obtained in this research will be presented. In addition, a detailed description of every step will be provided. Table 1 summarizes all the results obtained in the different regressions that were carried out, investigating the variables that had an influence on our dependent variable.

<div align="center">Initial Model:</div>

$$PWedge_t = \beta_{0,t} + \beta_{1,t}Inv_t + \beta_{2,t}logInfl_t + \beta_{3,t}DemCon_t + \beta_{4,t}LitRate_t + \beta_{5,t}ManImp_t$$

$$+\beta_{6,t}PolicyVariables_t + \beta_{7,t}DynasticVariables_t \tag{7}$$

---

[33]Russian project between economics and history professors with the aim to gather and develop the historical data for Russia

Table 1: Results

	1st OLS N=55	2nd OLS N=54	3rd OLS N=55	OLS (CA) N=54	Robust IV(2) N=54
const	3.786419 *** (0.988)	2.2246 (1.9313)	2.5788*** (0.3216)	0.7278*** (0.2608)	0.6855*** (0.4775)
Inv	-.0004821*** (0.001)	-0.000185*** (0.000185)	-0.000576*** (0.0001)	-0.0001*** (0.00005)	-0.0001*** (0.00007)
log_Infl	.1525* (0.097)	0.1372 (0.1153)	0.4935*** (0.7156)	–	–
DemCon	-.3316821*	-0.3604 (0.2548)	–	–	–
LitRate	3.246355* (1.744)	1.943 (3.2291)	–	–	–
ManImp	-.0001023 (0.001)	–	–	–	–
TsarTrade	–	0.0011 (0.0018)	–	–	–
Tsarism	-1.31648 *** (0.5287)	–	–	–	–
Stalinism	-3.250076***	–	–	–	–
War Communism	–	2.1987 (1.4298)	0.492158 (0.48299)	1.2061*** (0.2666032)	1.2218*** (0.33247)
NEP	–	2.4501 (1.7106)	–	–	–
VyshnegradskyGov	–	0.0642 (1.1339)	–	–	–
WitteGov	–	0.4383 (0.7952)	–	–	–
StolypinGov	–	0.4704 (0.5789)	–	–	–
FirstFYP	–	-0.3615 (1.9153)	-1.2502*** (0.4328)	-0.6528*** (0.2292)	-0.6612*** (0.15938)
SecondFYP	–	-0.2797 (2.1490)	-1.2248*** (0.5233)	–	–
ThirdFYP	–	0.2996 (2.3656	–	–	–
lagPWedge	–	–	–	0.8238*** (0.0526)	0.6687*** (0.69167)
R²	0.8843	0.9405	0.7865	0.9308	0.9308

Note: Standard errors are shown in parenthesis, being the values for the coefficients the firsts in the cell. In addition, the stars indicate the level of confidence of the results. (Three stars mean significant at a 95% confidence level).

Note for IV: The standard errors were made robust for heteroskedasticity.

 The first three columns (OLS) show the three first results of our empirical strategy (see section 5.1), where we attempted to test which periods and governments were significant in the reductions of the frictions in the production process. The last OLS regression (OLS CA)[34], in column 4, shows how autocorrelation was solved with the incorporation of the lagged dependent variable. The last column shows the estimates by instrumental variables (IV), robust for heteroskedasticity and no autocorrelation with two instruments. The importance of the IV estimates resides on the fact that the results will not be consistent and unbiased with the existence of endogeneity in our regression.[35] It should be noted that the estimations with IV are consistent but not efficient, that is the reason why we used two strong instruments, in order to increase the efficiency of our results.

In column 1, we regressed the main variables including the dynastic variables, Tsarism and Stalinism. These variables highly significant, however the coefficient of Tsarism is the opposite of what expected from the literature.

$$1\text{st OLS Model:}$$

$$PWedge_t = \beta_{0,t} + \beta_{1,t}Inv_t + \beta_{2,t}logInfl_t + \beta_{3,t}DemCon_t + \beta_{4,t}LitRate_t + \beta_{5,t}ManImp_t$$

$$+\beta_{6,t}Tsarism_t + \beta_{7,t}Stalinism_t \tag{8}$$

However, in the moment that the dynastic indicator variables for NEP and War Communism were incorporated, Tsarism became insignificant. Then, the research went one step further in our empirical strategy. We divided the two main dynastic variables (Tsarism and Stalinism) into dynastic variables recognizing the smaller periods of time, determined by the different governments and set of policies, allowing us to get into more detail on how the different enforced policies by the different governments affected the dependent variable of our study. Thus, the new dynastic variables were incorporated to the regression along with the rest of the main variables, as it can be seen in the second column. In addition, since Manufactured Imports were not significant, a policy variable was created (TsarTrade) to check for the effect that protectionism had during the Russian Empire. It should be said that although in the second column there are many variables, it was also attempted to check by different groups of regressors and observe their significancy.

$$2\text{nd OLS Model:}$$

$$PWedge_t = \beta_{0,t} + \beta_{1,t}Inv_t + \beta_{2,t}logInfl_t + \beta_{3,t}DemCon_t + \beta_{4,t}LitRate_t + \beta_{5,t}TsarTrade_t$$

$$+\beta_{6,t}WarComm_t + \beta_{7,t}NEP_t + \beta_{9,t}VyshneGov_t + \beta_{10,t}WitteGov_t + \beta_{11,t}StolGov_t + \beta_{12,t}1FYP_t$$

$$+\beta_{13,t}2FYP_t + \beta_{14,t}3FYP_t \tag{9}$$

The ones that maintained their significancy are written on the third column. An interesting insight, however, arises already from the second to the third columns. This surprising issue is that none of the

---

[34] CA stands for Corrected for Autocorrelation.

[35] The Hausman test for endogeneity showed that our OLS estimation was not consistent.

variables referring directly to Tsarism seems to be significant (except Investment). However, on a second thought this would make sense in the literature, since during Tsarist Russia, wedges were high and stable, due to the monopoly capitalism. As a consequence, this study could be expanded in this way, from previous years to 1885, to observe the formation of the latent frictions of the Russian Empire.

3rd OLS Model:

$$PWedge_t = \beta_{0,t} + \beta_{1,t}Inv_t + \beta_{2,t}logInfl_t + \beta_{3,t}WarCom_t + \beta_{4,t}1FYP_t + \beta_{4,t}2FYP_t \quad (10)$$

In column three, we can observe how the variable Investment is significant across all specifications. Inflation and the First & Second Five-Year Plans (1FYP & 2FYP) seems to be significant, whereas War Communism is not. This regression explains an interesting 78% of the variability of the production wedge. In addition, the variables, significant at a 95% level of confidence, have the sign we would have expected from the literature. Hence, column three seemed a good candidate for a final model however, once it was checked for autocorrelation with the Durbin-Watson test, it appeared that the model followed an AR(1)[36]. Hence, once the lagged dependent variable was incorporated to the model (column 4), Inflation and the Second five-year plan ceased to be significant, whereas WarCommunism turned statistically significant. This is represented in column four (OLS CA).

OLS (RA) Model:

$$PWedge_t = \beta_{0,t} + \beta_{1,t}Inv_t + \beta_{2,t}WarCom_t + \beta_{3,t}1FYP_t + \beta_{4,t}lagPWedge_t \quad (11)$$

Moreover, when checking for autocorrelation after the incorporation of the lagged dependent variable (lagPWedge), the Durbin's H test showed that the autocorrelation problem was solved. Nonetheless, the final model appears in the column five (Robust IV), in which the model was checked for endogeneity. The variable that we are concerned with is Investment since it may be determined jointly with the dependent variable (simultaneity) or because we may have an omitted variable which is correlated with this main variable. In order to make it exogenous we introduced two instruments that passed all the required tests, such as the Hausman test, Under-identification, Sargan-Hansen Over-identification and the Weak Instrument test (check appendix C). The instruments used are the Manufacture Output from 1885-1940, and ResIV3[37]. Consequently, the resulting model is robust, exogenous and consistent, allowing us to claim causal effects between the variables and the production wedge, and explaining the ninety-three percent of the Production Wedges variability.

---

[36] Breusch-Godfrey test showed an autoregressive model of order one. The results for the different econometrical tests can be seen in the Appendix C.

[37] The instrument ResIV is elaborated by lagging all the variables of the current model, and regressing them against the interested variable (Investment), from that estimation the residuals, that are used as an instrument, are kept.

Thus, our research concludes that the significant variables controlling for autocorrelation, endogeneity and robust for heteroskedasticity are:

Final Model (IV):

$$PWedge = \beta_{0,t} + \beta_{1,t}Inv_t + \beta_{3,t}WarCom_t + \beta_{4,t}LagPWedge_t + \beta_{5,t}1FYP_t$$

Hence from this model, it can be observed that the results are consistent with the literature. Investment is significant and negative, along with the First Five-Year Plan, implying that the emphasis in the investment strategy on heavy-industry by the imposition of high output targets in conjunction with the soft budget constraints were the responsible factors for the decline in the market frictions of the production process. Moreover, as Allen (2003) stated referring to trade: "exporting wheat and importing machinery, was not necessary for rapid growth, the soft budget constraints that the SOE enjoyed where enough to permit an effective mobilization of the otherwise unemployed labor." The mechanism behind this was that since the USSR did not enjoy full employment at the moment of the First Five-Year Plan, structural unemployment in the agricultural sector was enormous and growing, since mechanization was arriving to the countryside. Hence as marginal product of labor was equal to zero outside the cities, total output could be boosted by becoming workers for otherwise unemployed farmers. Thus, giving firms high objectives and credit would mean that they would not care for the marginal cost of labor, since minimizing costs were not their priorities. Consequently this was the source of growth in the Soviet Union during the 1930s. Nonetheless, as Cheremukhin et al. (2017) find, the growth rates of output were obtained at an extreme inefficient way. Indeed, one of the reasons that industrialization was deterred in the Russian Empire was a consequence of the personal comfort provoked by the favor treatments and subsidies of monopoly capitalism. Nonetheless, it should be mentioned, that Investment is one of the main variables that last for the whole period (1885-1940). Consequently, it could be mentioned that the Tsarist Russia possible reductions in the frictions (temporary as it was oscillating around an stable number) could be transmitted through investment as the railroad expansion (Wheat Boom booster).

On the other hand, it was also expected the result that War Communism would have in the model. The extreme situation of the Russian Civil War, just after the worst conflicts until the moment,World War I, could not have painted a more pessimistic panorama for Russia. Indeed, the situation already left the country without many of the previous skilled people. However, the policies applied by the *Bolsheviky* on the lands that they conquered day by day worsened the situation even more. They abolished all major capitalist institutions, confiscated land holding and the industrial capital from particular investors. Among their policies it also included forced requisitioning of food, redistribution of land, nationalization of industry, centralized management of production and resources, state monopoly of trade and the suspension of money transactions. The consequences of these acts translated into a determent of investment that made the frictions to sky-rocket. In addition it

should be said that the demographic convulsions effect could have been transmitted through the indicator variable of War Communism, explaining its non significancy. In the same way, inflation may have operated. The peak points for hyperinflation where those during War communism and after and before this episode it was more stable, even though it was growing during the Soviet Union.In addition, it should be said that the market frictions of the production process were greatly determined by the values of the previous year since it followed a continuous evolution and is not an stochastic variable. As the economic growth theory has been suggesting (Galor & Moav, 2008), education may play and important role in enhancing the structural change. Nevertheless, in this study, it has proven to be non significant. This fact can be caused by the fact that the companies had no need to hire new skilled workers since their profits were assured. In Soviet Russia, the logic would have change since the guidelines for a workplace do not follow the same incentives. Hence, the model is consistent with the literature behind the industrialization of the Soviet Union and the incapacity of the Russian Empire to perform this structural change.

8   Conclusion

This paper is an attempt to construct a bridge between the Economic History Literature and Economic Growth Theory. In doing so, it tries to better understand the role of frictions in deterring or permitting industrialization. As a matter of fact, one step in this way is to comprehend the attempts to industrialize during the government of Sergei Witte, or the modernizing will of Stolypin. Also understanding how the different policies, during Stalin, affected would be of importance. Indeed, the Lewis model of economic development (1954) used Soviet economic growth as the guide for constructing the industrial sector through investment reallocation of unemployment. It should be said, nonetheless, that the Russian economy was growing fast and there were reforms that could set Russia on track to eventually become one of the wealthiest countries in Europe and, by extension, of the world. This does not imply that this would have happened necessarily, but it was heading in the right direction.

Thus, the importance of studying, historically, how policies, conflicts, and different economic structures may boost or deter economic development resides on the fact that nations with great potential growth may not succeed in reaching their optimal performance. Hence, it would allow us to comprehend to a greater degree the evolution of societies in their own circumstances, being Russia a great example of this deed. Furthermore, it is also interesting to observe what may happen when different policies are applied during the same period of time. This would explain why Witte's and Stolypin's efforts did not achieved their original purpose. This study also deepens into the research of the effects caused by War Communism and the Russian Civil war, what in words of Cheremukhin et al. (2017) is of particular importance for the Russian scholars.

Hence, in order to achieve this objective an empirical model is proposed to fathom and capture the effects that the main economic variables, suggested in the literature, would have on the market frictions. The importance of this topic comes from the claim of many historians suggesting that market frictions were the most important obstacles to economic development in Russia. Our findings are consistent with the literature and growth theory. Particularly we found that the reduction in the production wedge is vastly explained by the investments and the policies carried out during the First Five-Year Plan, due to the existence of soft budget constraints for the SOE, easy credit from the *Gosbank* and high production objectives. This system provoked rapid industrialization since socialist companies' objective was to maximize output not profit. Hence, it would not matter the fact that the marginal product of labor would have been greater than the marginal cost or wage. Thus, Soviet rapid industrialization was accomplished by growing through employment expansion. However, this method was highly inefficient in productivity terms.

In addition, our discoveries also explain the peak levels of frictions between 1918 and 1922. This was a consequence of the terrible situation that Russia lived during that time, with millions perishing in the wars, famines or prosecutions. Indeed, the devastation caused by the conflicts, collectivization and nationalization generated one of the worse experiences for the world's biggest country. Moreover, this insight brings new information to this War period, which has so far been understudied. On the other hand, this model also explained why the Tsarist Period had no significancy in the wedge values, since frictions remained stable due to the fact that the same policies that caused it were carried out, monopoly capitalism. Moreover, this study provides more support to the rejection of the idea that the main driver of Russia's industrialization was a "Big-Push" model implemented by Stalin's economic goals. It has been seen that the inefficiency came from the stablished system, when higher productivity should have been expected. Furthermore, it rejects further the idea of the *obshchina* being the main impediment to development in the Russian Empire. Hence, it should be said that while some policies conducted economic growth in the USSR in the beginning of the 1930s, the side effects of many policies like the collectivization made a scant contribution to growth and living standards.

Finally, it would be interesting to mention that this study could be potentially extended by constructing a panel data for the different Russian regions for the same period. This extension would provide a better insight by acknowledging the fixed effects. Moreover, another potential extension would be the study of the evolution of the frictions in the production process from the beginning of the 19th century. This research could provide an intuition of how and when frictions emerged, since they were high and stable during the reign of Nikolay II. In addition, it would be appealing to expand the wedge accounting methodology towards other situations and countries in history, and apply the developed empirical strategy in our paper to link it with the literature.

References

Alder, Simeon, David Lagakos, and Lee Ohanian (2012) *The Decline of the U.S. Rust Belt: A Macroeconomic Analysis*. 2012 Meeting Papers 793, Society for Economic Dynamics.

Allen, Robert C. (2003) *Farm to Factory: a Reinterpretation of the Soviet Industrial Revolution*. Princeton University Press.

Banerjee, Anindya and Bill Russell (2002) *Inflation and Measures of the Markup*. EUI Working Paper ECO No. 2002/15. European University Institute, Department of Economics.

Barnett, Vincent (2004), *Catalysing Growth: Mendeleev and the 1891 Tariff*. Research in the History of economic Thought and Methodology, Vol. 22, Part 1, pp.123-124. Emerald Group Publishing.

Castañeda Dower, Paul and Andrei Markevich (2013) *Land Tenure and Productivity in Agriculture: The Case of the Stolypin Reforms in Late Imperial Russia*. Mimeo, New Economic School, Moscow.

Central Bank of the Russian Federation (2000) *The State Bank of the USSR*. History, Bank of Russia Today. Public Web Page. https://www.cbr.ru/eng/today/cbrf_itm/gbsssr/

Central Bank of the Russian Federation (2007) *Nalichnyye den'gi, vypushchennyye v obrashcheniye, po emissionnym balansam na konets goda, MLN. R.*. Archive funds

Chari, V. V., Patrick Kehoe, and Ellen McGrattan (2007) *Business Cycle Accounting*. Econometrica, 75(3), pp. 781-836.

Cheremukhin, A., et al., (2013) *Was Stalin Necessary for Russia's Economic Development?*. CEPR Discussion Papers 9669, C.E.P.R. Discussion Papers.

Cheremukhin, A., et al., (2017) *Industrialization and Economic Development of Russia through the Lens of a Neoclassical Growth Model*, Review of Economic Studies. 84 (2), pp. 613-649.

Conroy, Mary (2006) *Civil Society in Late Imperial Russia*. Russian Civil Society: A Critical Assessment. New York.

Crisp, Olga (1978) *Labor and Industrialization in Russia*. Cambridge Economic History of Europe, Vol. 7, part 2. Cambridge University Press.

Davies, R.W., Harrison, M., and Wheatcroft, S.G., (1994) *The Economic Transformation of the Soviet Union 1913-1945*. Cambridge University Press.

Drummond, Ian M. (1976) *The Russian Gold Standard, 1897-1914*. The Journal of Economic History, Vol 36, No. 3(September), pp. 663-688. Cambridge University Press

Efremov, Steven (2012) *The Role of Inflation in Soviet History: Prices, Living Standards, and Political Change*. Electronic Theses and Dissertation, Paper 1474. School of Graduate Studies, East Tennessee State University.

Figes, Orlando (2014) *A People's Tragedy: The Russian Revolution 1891–1924*. London: The Bodley Head. ISBN 9781847922915.

Galor, Oded and Omer Moav (2006) *Das Human-Kapital: A Theory of the Demise of the Class Structure*. Review of Economic Studies 73, pp. 85-117. The Review of Economic Studies Limited

Gerschenkron, Alexander (1947) *The Rate of Growth in Russia: The Rate of Industrial Growth in Russia, since 1885*. The Journal of Economic History, Vol. 7, Supplement: Economic Growth: A Symposium, pp. 144-174. Economic History Association, Cambridge University Press.

Gerschenkron, Alexander (1952) *An Economic History of Russia*. The Journal of Economic History, Vol. 12, No. 2, pp. 146-159. Economic History Association, Cambridge University Press.

Gerschenkron, Alexander (1963) *The Early Phases of Industrialization in Russia: Afterthoughts and Counter-thoughts*. In: Rostow W.W. (eds) The Economics of Take-Off into Sustained Growth. International Economic Association Series, pp 151-169. Palgrave Macmillan, London.

Gerschenkron, Alexander (1965) *Agrarian Policies and Industrialization, Russia 1861–1917*. The Cambridge Economic History of Europe. Volume VI: The Industrial Revolutions and After: Incomes, Population and Technological Changes (II), pp. 706-800. Cambridge University Press.

Gordon, Manya (1941) *Workers Before and After Lenin*. New York: E.P. Dutton & Co.

Gregory, Paul and Joel W. Sailors (1976) *Russian Monetary Policy and Industrialization, 1861-1913*. The Journal of Economic History. Vol. 36, No 4, pp. 836-851. Cambridge University Press.

Gregory, Paul (1982) *Russian National Income, 1885–1913*. pp. xiv, 359. New York: Cambridge University Press.

Gregory, Paul, and Robert Stuart (1986) *Soviet Economic Structure and Performance*. New York: Harper & Row.

Hayashi, Fumio, and Prescott, Edward (2008) *The Depressing Effect of Agricultural Institutions on the Prewar Japanese Economy*. Journal of Political Economy. 116(4), pp. 573- 632.

Herrendorf, B., Rogerson, R., & Valentinyi, A. (2014) *Growth and Structural Transformation*. Handbook of Economic Growth, Vol. 2, pp. 855-941.

Kafengaus, Lev Borisovich (1994) *Evolyutsiya promyshlennogo proizvodstva Rossii (Poslednayaya tret' XIX v. - 30-ye gody XX v.)*. Epifaniya, Series: "Pamyatniki Ekonomicheskoy Mysli". ISBN 5-86170-005-2

Kahan, A. (1967) *Government Policies and the Industrialization of Russia*. Journal of Economic History, 27, pp. 460-77.

Lenin, V. I. (1894) *The Development of Capitalism in Russia*. vol. 3, pp. 74-75. Collected Works. Moscow: Progress Publishers.

Lozovsky, Solomon A. (1920) *The Role of the Labor Unions in the Russian Revolution*. The Union Publishing Association, New York.

Markevich, Andrei and Mark Harrison (2011) *Great War, Civil War and Recovery: Russia's National Income, 1913 to 1928*. The Journal of Economic History. Vol. 71, No. 3, September, pp. 672-703.

Maureen, Perrie (1972) *The Russian Peasant Movement of 1905-1907: Its solcial composition and revolutionary significance*. Past & Present, Vol- 57, Issue 1, November, pp. 123-155.

McCaffray, Susan P. (1996) *The Politics of Industrialization in Tsarist Russia: The Association of Southern Coal and Steel Producers, 1874-1914*. Northern Illinois University Press.

Meng, Xin, Nancy Qian and Pierre Yared (2010) *The Institutional Causes of China's Great Famine, 1959-61*. Working paper 16361, NBER Working Paper Series.

Mironov, Boris N. (1991) *The Development of Literacy in Russia and the USSR from the Tenth to the Twentieth Centuries*. History of Education Quaterly, Vol. 31, No.2, Cambridge University Press.

Murphy, Kevin M., Andrei Shleifer and Robert W. Vishny (1989) *Industrialization and the Big Push*. Journal of Political Economy, 97(5), pp. 1003-1026.

Parente, Stephen, and Edward Prescott (1999) *Monopoly Rights: A Barrier to Riches*. American Economic Review, 89(5), pp. 1216-1233.

Peterson, F., Wesley, E., (2017) *The Role of Population in Economic Growth*. SAGE Open, Vol. 7, Issue 4. SAGE Publications Inc.

Stepanov, Valery Leonidovich (1996). *Three Ministers of Finance in Postreform Russia*. *Russian Studies in History* 35(2).

Tolts, Mark. (1995). *The Soviet Censuses of 1937 and 1939: Some Problems of Data Evaluation*. Conference: Conference: International Conference on Soviet Population in the 1920s and 1930s, Toronto, 27-29 January 1995.

Van Der Kiste, John (2003) *The Romanovs: 1818–1959*. Sutton Publishing Ltd, UK. ISBN 9780750934596

Von Laue, Theodore (1963) *Sergei Witte and the Industrialization of Russia*. University of Columbia, Russian Studies Institute. Columbia University Press.

Appendix A: Data

A) Wedge Production Component

The production component of the labor wedge has been taken from Cheremukhin et al (2017) for the period previous to the WWI and from 1928 until 1940. For 1914-1928 the production component of the labor wedge has been computed following the formula (5) in Section 4 of this paper. The data has been taken from Markevich & Harrison (2011) for the WWI period and also from the IstMat (*Istoricheskiye Materialny*) and the Russian Statistics Library.

B) Investment

The data accounting for the Investment in the Manufacturing sector has been extracted from Cheremukhin et al (2017). The researchers computed investments in each sector from the series of capital stocks assuming 5 percent depreciation. Simultaneously, they extracted the values for the GNP from NNP series in Gregory (1982), Table 3.1, by adding 5 percent depreciation to the total capital stock. The authors did not find reliable data for value added in manufacturing and agriculture for all years. Gregory also reports the breakdown of imperial and local government expenditures for selected years (Tables F.4 and G.4). Moreover, for the benchmark analysis we took defense expenditures as our measure of government sector and the scholars checked the robustness of our conclusion by added administrative expenditures. The data for the missing years was obtained by linear interpolation. To obtain relative prices, the scholars computed nominal value added of agriculture following the same steps as we did for the value added in agriculture in 1913 prices. The ratio of the two gives us a price deflator for agriculture. Gregory in Tables 3.1 and 3.2 reports net investments in current prices and 1913 prices, which permitted to compute the investment price deflator and depreciation in current prices.

C) Production (Industry Output)

Reliable data for value added in manufacturing was extracted from Cheremukhin et al. (2017). The authors estimated the values for the the whole Imperial period and the Soviet Union until 1940 except the War Period (WWI and Civil War). In order to obtain the data, the authors took the evidence from Gregory (1982). Particularly, it was assumed that the fraction of value added of agricultural production to the retained consumption was at the same level as in 1913 to obtain the estimate of value added in agriculture during 1885-1913. Thus, the value added in manufacturing was obtained by subtracting the value added in agriculture from GNP. Gregory reported breakdown of imperial and local government expenditures for selected years (Tables F.4 and G.4). However, a bi-sector economy (agriculture and manufacture) was considered in Cheremukhin et al (2017). Therefore the manufacturing sector

incorporated the military and the government expenditure (civilian services). Nonetheless, the authors checked the robustness of their conclusion with positive results. Finally, for the war period (1914-1928), the data obtained by Markevich & Harrison (2011) was used. These results were classified into different categories. Consequently, in this paper they were added up to form a dual economy, where the gross industrial output is equivalent to the manufacturing output, coinciding with the estimates of Cheremukhin et al (2017). These results were checked with the statistical book of Kafengaus (1994) about the evolution of industrial production of Russia, with a satisfactory outcome.

D) Inflation

The values for price indexes, CPI evolution or the inflation are non-existent or incomplete for the whole analyzed period previous to this study. Consequently, it has been considered to take the amount of currency in circulation (in millions of rubles, 1913) as a proxy for Inflation. The main reason supporting this assumption, besides the fact that since velocity of money was not highly determinant for the period except WWI (Efremov, 2012), lays on the fact that for the Imperial period the financial markets in Russia were not developed enough and suffered from backwardness in comparison to the English, German or French financial systems, as stated by Allen (2003). Moreover, in tune with Efremov (2012) for the Soviet period, the official inflation may not indicate the real one, since due to the monetary restructures, the ban on foreign exchange rates and the prices policies (scissors policy) would lead to the existence of a repressed inflation not represented in the official accounts. Consequently, a conversion of the soviet ruble is carried out, in order to provide a faithful accountancy for the currency in circulation, expressing the subjacent inflation for the whole studied period. In addition, it should be mentioned that for an important amount of years the currency was pegged to the gold standard, 1897-1914 and 1922-1930 (the later with the *chervonets*). In order to proceed with the extrapolation of the data, the values have been extracted from Drummond (1976). Indeed, the author provided the amount of currency in circulation in 1913 rubles (₽) for 1885-1914. For the previously missing data at the WWI, the data was taken from Markevich & Harrison (2011) where the estimated values for the 1914-1924 lapse are provided in 1913's rubles. Furthermore, for the Soviet period, the values were taken from the 1924's ruble, established by the *Gosbank* completing the monetary reform initiated in 1922, and the amount of currency in circulation for that time, in order to obtain the amount of cash and banknotes in 1913 values. The 1924's currency was exchanged for 50,000 rubles of the 1923 issue or 5 million rubles of 1922. Consequently, the exchange wound be 1₽ of 1924 is 50,000,000,000₽ of the issues prior to 1922 (1893-1922). Finally, the amount of 1924's currency in circulation has been taken from the pages of the archives of the bank of the Russian federation, particularly from the figure: "Cash issued in circulation, by issue balance sheets at the end of the year, million ₽" (rus.: наличные деньги, выпущенные в обращение, по эмиссионным балансам на конец

года, МЛН. ₽.). The resulting estimation fits well the literature of the inflation during the studied period.

E) Manufacturing Net Import and Protectionism

The data for the total volume of exports and imports for Tsarist Russia is extracted from Gregory (1982), Table M-1. Moreover, the data from Davies (1990, Table 56) is used to find the composition of exports and imports for 1913. Thus it is assumed that this composition holds for 1885-1913, since Kitanina (1995) showed that the composition of trade changed very slowly in 1899-1913 (there are no reliable data before 1899). The share of industrial products in exports was 4.7% in 1899-1903 and 5.6% in 1913; the share of industrial products in imports was 29.3% in 1899-1903 and 32.8% in 1913. Hence, the net exports of agricultural goods and net imports of non-agriculture goods are computed. On the other hand, from Davies et al. (1994), the volume of exports and imports for the USSR from 1928 to 1938 is extracted. They provided an index of exports and imports relative to 1913, and the scholars use the numbers for 1913 trade from Gregory (1982) to obtain the volume of trade in 1913 prices. The authors impute the values for 1939 and 1940 by assuming that they remain at the 1938 level. They use the data from Davies (1990, Table 58) to find composition of exports and imports for 1927/1928. They assume that the same composition holds for 1928-1940 and compute net exports of agricultural goods and net imports of non-agricultural goods.

F) Population

The population for the fifty six year lapse of the Russian Empire and the Soviet Union have been taken, primarily, from Gregory (1982), Table 3.1., and Davies (1994), Table 7. However, some modification were taken into account, in order to improve the accuracy and reliability of the treated data. Indeed, the only imperial population census was held in 1897 and, in the following years, the authorities registered the deaths and births more precisely. Nonetheless, they did not count the out-migration of peasants to cities or to Siberia. Thus, they calculated simultaneously these newcomers at their new residences. Therefore, the data was erroneously gathered, creating a double counting that overstated the real population. Moreover, the convention for treating the Russian Empire population consisted of deducting the population of Finland from the Empire. It should be mentioned that Finland was incorporated to the Russian Empire in 1809, as the Grand Duchy of Finland, and became independent in 1917. Hence, it did not form part of the USSR and it was also a different entity during the Empire, since after the Finnish war, between Sweden and Russia, the Diet of Porvoo (1809) pledged allegiance to Aleksander I of Russia who in return guaranteed that the area's laws and liberties, as well as religion, would be left unchanged. In addition, it has been considered in this research that the population of Poland was also to be subtracted. In order to accomplish this objective,

the population for Congress Poland (Privislinsky Krai or Vistula Country) was estimated from 1885 to 1915/1918 and subtracted from the total Russian population (excluding Finland already). The logic behind this action was that Poland just lasted in Russia until the WWI, hence the changes in population due to the unrest of that period could have seemed even bigger than the actual ones. Moreover, during the USSR, Poland was not part of it until its last partition with the Molotov-Von Ribbentrop Pact and the subsequent invasion in 1940. Moreover, the data from Davies (1994) and Gregory (1982) lacked the war period population since the first Soviet census was conducted in 1926. Consequently, the population on the eve of the First World War was estimated by primarily using data from the registration of births and deaths for the years 1897-1914. Moreover, the war period population was extracted from Markevich & Harrison (2011), where the authors fill the gap in the national accounts of Russia and the USSR in the twentieth century, 1913 to 1928. From this paper it could be found that the Russian economy did somewhat better in the Great War than was previously thought; in the Civil War it did correspondingly worse; war losses persisted into peacetime, and were not fully restored under the New Economic Policy. The Great War and Civil War produced the deepest economic trauma of Russia's troubled twentieth century.

G) Literacy Rate

The literacy rate for the Russian Empire was estimated, taking the basic evidence from the work of Mironov (1991), which computed the average rate for the whole Russian population by decades (men, women, rural and urban), from 1717 until 1917. Hence, in our study, the literacy growth rate has been interpolated from the averaged decades and for specific years, from the different population censuses and data available from the Russian Statistics Library and the IstMat (*Istoricheskiye Materialny*). The interpolated data adapted to the historical events correctly. Moreover, for the Soviet Union period, from 1928 until 1940, the literacy rates were extracted from Cheremukhin et al. (2017), by averaging the Rural and Urban literacy rates provided by the authors. In addition, it should be mentioned the fact that the the war period has been also estimated in an attempt to link the deceleration suffered in the Tsarist territory against the promotion in the Soviet Territory (LikBez), this estimates were taken from Markevich & Harrison (2011).

Appendix B: Table

Data Table

year	Wedge Production Component	Investment	Production (Industry Output)	Inflation	Manufacturing Imports	Population	Literacy Rate (average)
1885	2,82	502,25	3915,29	901	299,85	101.860	0,2060
1886	3,18	405,85	4011,91	950	304,65	103.581	0,2110
1887	3,03	431,80	4835,56	982	239,43	105.302	0,2160
1888	3,21	515,30	4761,40	982	167,58	107.023	0,2180
1889	3,18	708,25	5011,50	940	258,73	108.450	0,2200
1890	3,12	343,60	4651,61	902	221,66	109.744	0,2301
1891	3,01	382,65	4886,37	977	193,85	110.422	0,2403
1892	2,46	793,55	4697,30	1070	281,25	111.100	0,2504
1893	2,65	1203,55	5001,10	1084	319,40	113.059	0,2605
1894	3,94	1606,30	6298,37	1072	394,15	114.018	0,2706
1895	3,41	-119,65	5698,44	1048	352,69	114.865	0,2808
1896	3,94	1298,80	6618,40	1055	431,37	115.712	0,2909
1897	4,15	1512,65	7148,12	1068	391,72	117.241	0,3010
1898	3,23	1175,05	6981,53	901	425,12	118.372	0,3073
1899	3,19	922,85	7564,02	662	485,15	119.546	0,3137
1900	3,17	984,10	7631,50	491	445,71	120.186	0,3200
1901	3,64	1248,15	8802,83	555	392,80	124.806	0,3247
1902	3,28	1783,15	9068,75	523	354,96	126.613	0,3294
1903	3,58	896,15	8507,31	578	375,56	128.419	0,3341
1904	3,11	1185,25	9449,49	854	360,45	130.418	0,3389
1905	3,98	171,25	9554,01	1208	329,27	133.225	0,3436
1906	4,15	1184,65	9251,99	1195	437,92	135.044	0,3483
1907	2,89	1159,20	8413,32	1155	492,88	137.862	0,3530
1908	2,71	1223,40	9401,62	1087	587,23	140.640	0,3608
1909	2,92	1259,90	9885,25	1174	456,36	142.328	0,3687
1910	3,77	1872,50	11098,84	1235	586,22	144.533	0,3765
1911	4,08	1744,55	11275,42	1327	591,53	146.003	0,3843
1912	3,38	1781,20	11161,60	1495	614,78	148.261	0,3922
1913	3,78	1781,20	11296,00	1630	769,66	150.391	0,4000

year	Wedge Production Component	Investment	Production (Industry Output)	Inflation	Manufacturing Imports	Population	Literacy Rate (average)
1914	2,86	1961,20	11589,00	2947	824,54	152.127	0,4058
1915	2,75	2100,5	12162,00	5617	902,75	154.249	0,4115
1916	2,94	1570,7	11265,00	9097	785,48	153.851	0,4173
1917	3,24	876	8398,50	18917	620,31	152.807	0,4230
1918	3,73	181,3	3666,00	27300	554,7	148.057	0,4290
1919	5,67	-818,70	2901,00	60800	498,9	144.829	0,4350
1920	7,3	-1183,6	3353,00	225014	318,8	142.829	0,4410
1921	7,8	-1700,5	3083,00	1168600	214	139.068	0,4803
1922	7,2	-1234,28	3411,00	17543900	147,5	137.684	0,5196
1923	6,95	-668,33	3935,00	1994500000	259	137.827	0,5589
1924	7,05	53,42	4948,00	178510000000	398,7	140.196	0,5981
1925	6,84	354,68	6583,00	50000	425,34	143.163	0,6374
1926	6,53	749,35	8199,00	125000	479,8	145.781	0,6767
1927	6,31	1185,72	9032,00	150000	513,7	148.656	0,7160
1928	5,32	1409,43	10137,85	200000	599,10	151.522	0,7320
1929	4,02	1562,98	11250,35	250000	484,65	154.687	0,7480
1930	2,59	3351,60	12879,93	300000	569,88	156.100	0,7640
1931	2,17	3942,32	13976,76	350000	779,65	158.600	0,7800
1932	1,71	2612,81	14509,51	475000	476,94	160.800	0,7960
1933	1,53	2916,79	14775,88	400000	191,75	159.800	0,8120
1934	1,3	3545,11	16468,13	450000	202,01	157.500	0,8280
1935	1,32	5578,95	18755,81	500000	286,11	159.200	0,8440
1936	1,14	5279,67	21842,60	750000	366,85	161.300	0,8600
1937	1,41	5706,65	23064,79	1000000	325,58	164.000	0,8760
1938	1,23	5706,65	24380,98	1500000	440,18	167.000	0,8920
1939	1,17	7811,79	26370,95	2000000	440,18	168.524	0,8970
1940	0,95	6957,04	27828,17	2000000	440,18	173.100	0,9080

Appendix C: Econometric Tests

Durbin-Watson Critical Values at 5%, n = 55, k = 5

  dL = 1,3743

  dU = 1,7681

Durbin-Watson d-statistic(k = 5,   55) =   0.980728

Durbin-Watson h-statistic: -.1708061 t = -1.116675 P-value = 0.2698

  Tests of Endogeneity

  Ho: variables are exogenous

  Robust score chi2(1)   = 1.36214 (p = 0.2432)

  Robust regression F(1,48)   = 1.57656 (p = 0.2153)

Tests of endogeneity

  Ho: variables are exogenous

  Robust score chi2(1)   = 1.36214 (p = 0.2432)

  Robust regression F(1,48)   = 1.57656 (p = 0.2153)

Underidentification test (Kleibergen-Paap rk LM statistic):   13.355

                                    Chi-sq(2) P-val =   0.0013

Weak identification test (Cragg-Donald Wald F statistic):   858.392

                (Kleibergen-Paap rk Wald F statistic):   1964.867

Stock-Yogo weak ID test critical values: 10% maximal IV size   19.93

                            15% maximal IV size   11.59

                            20% maximal IV size   8.75

                            25% maximal IV size   7.25

Source: Stock-Yogo (2005). Reproduced by permission.

NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.

Hansen J statistic (overidentification test of all instruments):   0.029

                                    Chi-sq(1) P-val =   0.8656