The Hungarian hyperinflation:
A look into the production side

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Abstract. This paper focuses on what happened to industrial production during and after Hungary's record-breaking hyperinflation of 1945-46 – an angle that has not been covered extensively by previous authors. The industries covered are coal, railways, agriculture and mining. This paper then explores the relationship between post-World War II production and hyperinflation, as well as Hungary's recovery from hyperinflation and World War II relative to other countries.

Keywords. Hungary, Hyperinflation, Orthodoxy.

JEL. N14, N17.

1. Introduction

T o date, there have been 56 recorded hyperinflation episodes in history (Hanke & Krus, 2012). Many people have heard anecdotes of Germany in the early 1920s, where a loaf of bread cost a barrel full of money, or Zimbabwe in 2007-08, where the inflation rate was a "zillion" percent. However, few know of the greatest hyperinflation of all time, where, at the peak, prices doubled every 15.6 hours and notes were issued in denominations of 100 million pengőes and 1 billion pengőes (Hanke & Krus, 2012). This hyperinflation episode started in Hungary in August 1945, and stopped in July 1946, when the worthless Hungarian pengőwas replaced with the Hungarian forint. There were efforts during the episode to stabilize the currency, most notably with a tax pengő index, where conversion rates were adjusted every day to account for rising prices (*Encyclopedia of Money*). The tax pengő (adopengő), however, also ended up hyperinflating. Stabilization occurred on August 1, 1946 when the Hungarian government issued a new currency—the Hungarian forint. The hyperinflation was so extreme that the final conversion rate was 400 octillion (4 followed by 29 zeros) pengőes for just one forint (Exchange Currency).

This paper focuses on the production side of industries shortly after World War II (WWII) and their relationship with hyperinflation. Many factors contributed to Hungary's hyperinflation episode, such as astronomically high rates of money printing, decreased production across all sectors, high war reparations, destroyed capital, and loss of gold

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reserves (John Doe Is Taken to the Cleaners). The paper will first go through the basic production and price data of the coal and railway industries, agriculture, and mining. It will then examine the relationship between output and hyperinflation.

2. Basic data

During WWII, Hungary sided with the Axis powers. Hungarian and German forces were defeated by Soviet forces in 1945 (Hoensch, 1996). Early in the war, Hungarian troops fought at Stalingrad, suffering many deaths. In 1944, Hungary itself became a battleground and suffered major consequences from WWII (Grossman & Horváth, 2000). These included loss of population amounting to 400,000 persons—4.34 percent of the 1939 pre-war population—land, capital, and gold (Hungarian Central Statistical Office; National Bank of Hungary, *Hungary in Statistical Tables*, 1947). Statistics and charts below display the effect WWII had on Hungary's economy. Chart 1 displays the losses in various sectors that Hungary suffered, calculated as a percentage of its national wealth before the war. Chart 2 is another depiction of data that recorded the loss of national income after WWII, and the loss each component of national income had. These numbers were indexed to pre-war levels of 1938/1939. From these charts, it is evident that Hungary's economy endured heavy losses as a result of WWII. All sectors, with the exception of rental dwellings, fell in value of at least 40 percent.

To examine Hungary's economy more in depth, let us look at some macroeconomic variables before and after the war. Chart 3 shows Hungary's GDP per capita in 1990 Geary-Khamis international dollars. The source did not provide data for 1943-1945.

We can assume that figures were not recorded or reported during this time period, or that further digging would need to be done in order to discover these numbers.
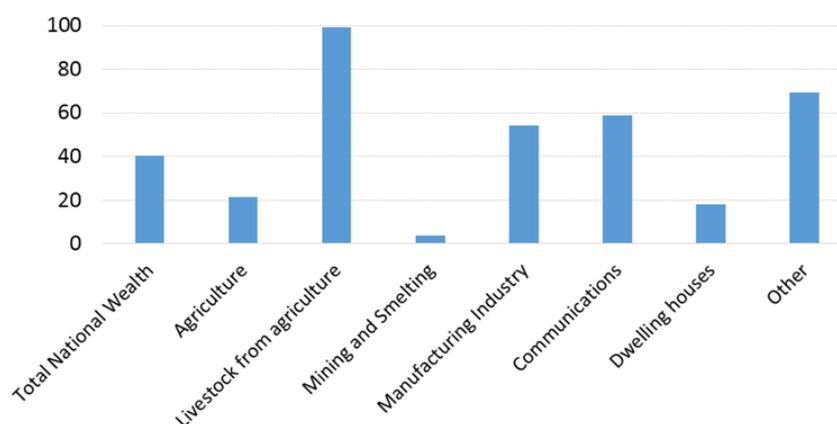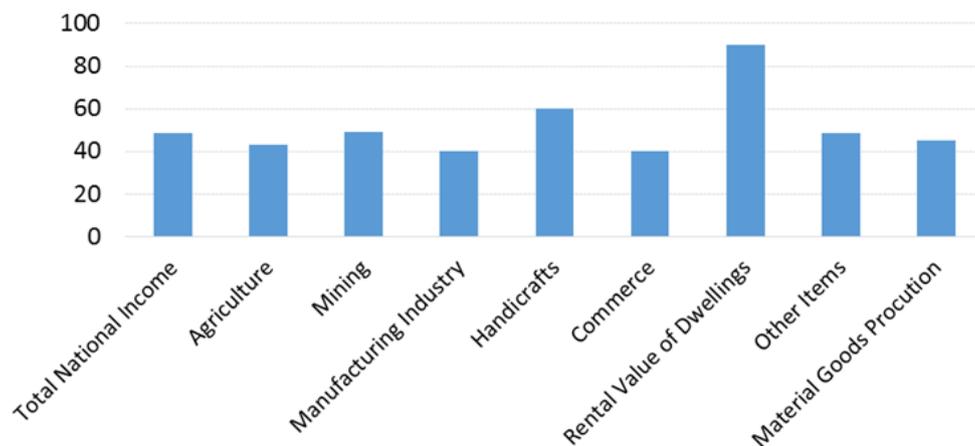

**Figure 1.** *Losses from WWII (% of National Wealth)*

Notes: *Source did not indicate if it included territorial losses, or which territory numbers were based on. **Source:** National Bank of Hungary, *Hungary in Statistical Tables,*(1947),p. 32.

Figure 2. *Hungarian National Income, 1945/1946 (as % of 1938/1939)*
Source: National Bank of Hungary, *Hungary in Statistical Tables*,(1947),p. 33.
Notes: *Source does not specify territory includes or specifics of 1945/1946 calculations.
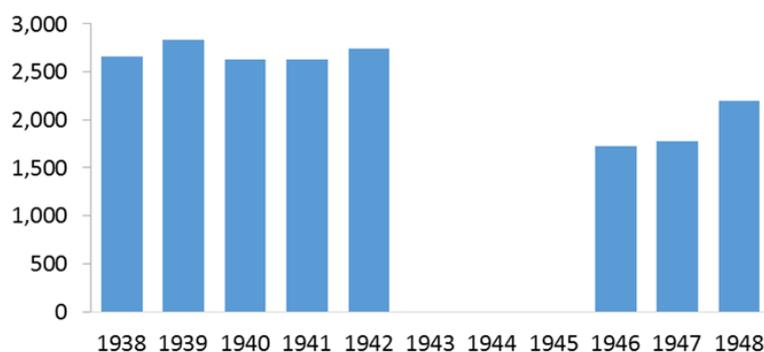
Figure 2. *Hungarian GDP per Capita (1990 International Gheart-Khamis dollars)*
**Source:** Maddison Project (2013).

However, we can see from Chart 3 that GDP per capita decreased between 1942 and 1946.GDP per capita then began to slowly rise after the war. The next part of the paper will explore this trend through analyzing different industries and their production. These industries include coal and railway industries, agriculture, and mining/oil. There are, however, other sectors in the economy that add to overall GDP. The industriesjust mentioned were chosen because of their importance in production post-WWII and their availability of data. With increased production of different sectors after WWII, Hungary's GDP per capita was able to rise.

3. Coal and railways

It is important to take a further look into the industries and sectors that were affected by the war. We will first examine the coal and rail industries, as their decline in production and capital created substantial burdens for economic recovery and productivity. In Chart 4, we find coal production statistics. The red line shows the pre-war levels of coal production. Within two years after WWII coal production recovered to pre-war levels.

Additionally, the railway industry was affected by the war; train lines and capital associated with the railway industries were destroyed. Tables 1aand 1b show the damage that the Hungarian railway industry withstood. Coal and railways were grouped together here because their decrease in production and capital is arguably the most important in terms of economic recovery. Without coal, there was little electricity and production across all industries was affected. For example, there was limited heat in hospitals. Further, the loss of capital associated with railways caused problems fortransportation of goods and people for personal travel. All personal travel was restricted andrailways were only to be used for factory workers and professional needs (Vas & Gonda, 1977).
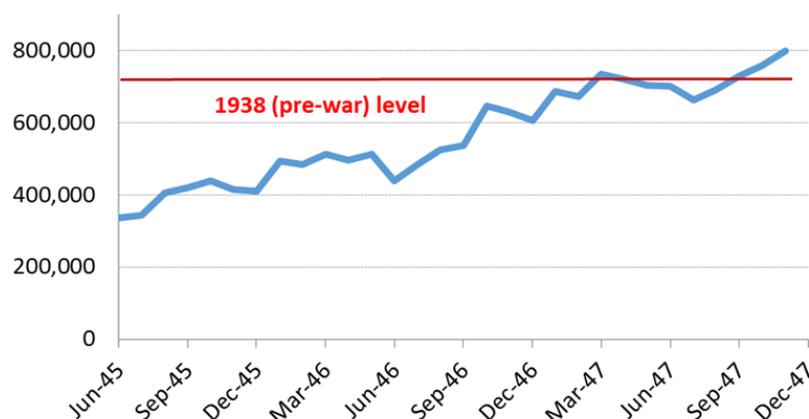
Figure 4. *Coal production, 1945-1947 (tonnes)*
Source: Adapted from Siklos (1991), Table M6. His cited source: MNBHK, XX (Oct. - Dec. 1946), p. 263. GT, 1947, pp. 683-84.

Table 1a. *Railway Inventory, 1938 versus December 1945*

	Inventory (1938)[1]	Completely Wrecked	Damaged but Repairable	Fit for Operation
Locomotives				
Steam	1,962	173	154	470
Electric	59	12	17	7
Other	2			
Total	2,023	185	171	477
Motor rail cars	507	64	188	96
Motor rail autobuses	40	6	12	4
Passenger cars and motor rail car trailers	4,574	431	780	705
Combination baggage cars	1,218	136	125	169
Mail cars	363	31	26	67
Freight Cars				
Box	17,313	1,130	914	1,540
Refrigerator			60	100
Open	27,913	1,427	1,193	4,064
Timber			166	346
Tank	166	101	131	298
Others	3,757	74	154	1,187
Total	49,149	2,732	2,618	7,535

Source: Ecker-Racz, 1 June 1946, p. 34. Information is incomplete.
Notes: [1]Changes between 1938 and 1944 disregarded because present area of Hungary is that of 1938.
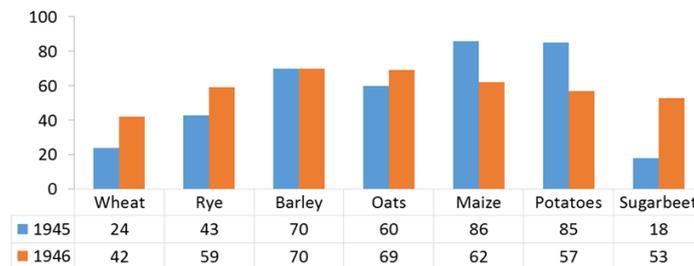
Table 1b: *Railway Damage*

	June 198 level	Destroyed or damaged during WWII
Length of railways in kilometers	11,488	4,146
Switching apparatus	13,784	5,330
Length of tunnels in meters	3,571	300
Railroad bridges		537
Culverts		311

Source: National Bank of Hungary, *Hungary in Statistical Tables* (*1947*).

Restrictions ontransportation stopped goods from being shipped across the country. In addition, many bridges around Budapest were destroyed, which further impeded transportation of goods (Grossman & Horváth, 2000; Vas & Gonda, 1977).

3. Agriculture and livestock

The year1945 wasa particularly bad one for agriculture. Hungary experienced a bad harvest, partly attributable to drought: expected wheat production was 3 million tons, while the actual production was only 1 million tons (*Hungary in Statistical Tables,* National Bank of Hungary, 1947; Vas & Gonda, 1977). The following are statistics for agricultural yields and numbers of livestock left after WWII. Charts 5 and 6 paint a grim picture ofthe agrarian outlook in 1945 for Hungary. All products, with the exception of potatoes and maize, saw increased production in 1946, but although yields were rising, they remained well below pre-war levels.

	Wheat	Rye	Barley	Oats	Maize	Potatoes	Sugarbeet
1945	24	43	70	60	86	85	18
1946	42	59	70	69	62	57	53

Figure 5. *Yield of Most Important Agricultural Products in Hungary (% of 1938 Levels)*
Source: National Bank of Hungary, *Hungary in Statistical Tables* (1947), p.5. **Notes:** *Based on the territory of the country as outlined in the Treaty of Trianon.

	Horses	Cattle and Buffalo	Pigs	Sheep
1945	45	53	37	18
1946	49	58	43	23
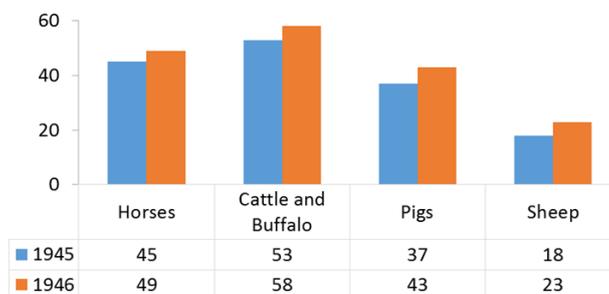
Figure 6. *Livestock in Hungary (% of 1938)*
Source: National Bank of Hungary, *Hungary in Statistical Tables* (1947), p.6. **Notes:** *Based on the territory of the country as outlined in the Treaty of Trianon.

With lower yields, and the government introduced a rationing system and the diet of Hungarians changed. Simultaneously, prices of agricultural products began to increase because of higher price levels and shortages. Chart 7 shows monthly log scale data for agricultural prices of wheat, barley, and maize for the year of 1946. The axis uses a logarithmic scale because prices rose at such an astronomical rate.
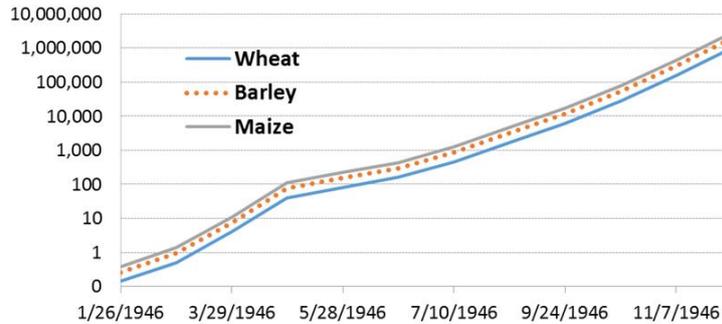

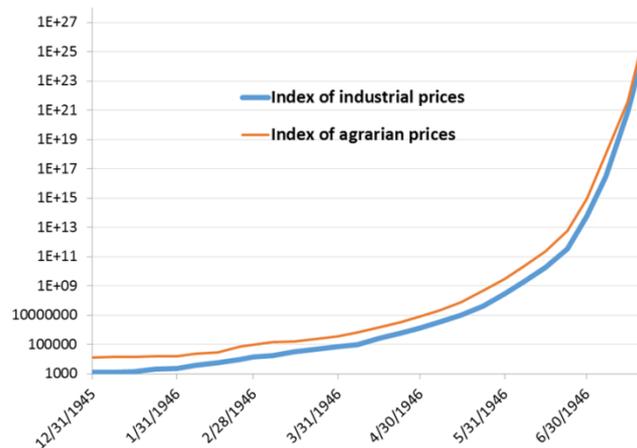**Figure 7.** *Log scale, Prices of Wheat, Barle, and Maize (milpengos per quintal)*

Figure 8. *Log Scale Index for Industrial Prices and Agrarian Prices (October 1, 1945=100)*
Source: Hungarian Central Creditbank, August 1946

Combining both agrarian and industrial sectors, Chart 8 reviews the price index for both sectors in the year of 1946. The increase of prices for both sectors is dramatic. Further calculations show that the two lines have a correlation of 1, showing that the prices for each sector rose proportionally.

4. Mining/Oil

The last industry this paper will cover is mining. As expected, the mining industry was also hit hard by WWII. Chart 9 shows production of various minerals for 1938, the second half of 1945, and the first half of 1946 (the latter two being the periods that Hungary experienced hyperinflation). We can see that production of all minerals, with the exception of petroleum, decreased after WWII—most notably natural gas, which experienced a 99.01 percent reduction. Products of the mining industry

were used for heat, energy, and raw materials for other goods. All minerals, with the exception of black carbon and petroleum, increased production from their 1945 levels in 1946.
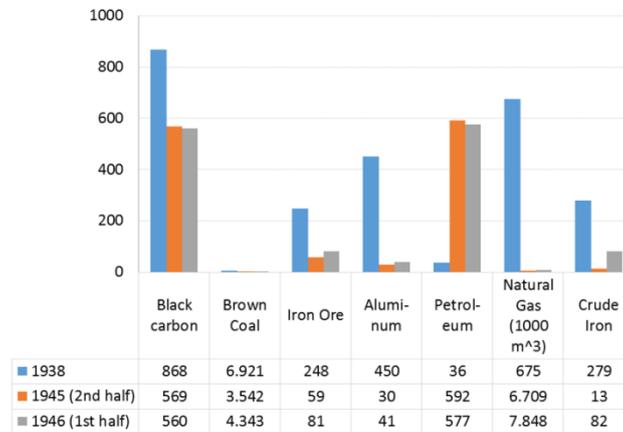

	Black carbon	Brown Coal	Iron Ore	Alumi-num	Petrol-eum	Natural Gas (1000 m^3)	Crude Iron
1938	868	6.921	248	450	36	675	279
1945 (2nd half)	569	3.542	59	30	592	6.709	13
1946 (1st half)	560	4.343	81	41	577	7.848	82

Figure 9. *Mining Production Data (units in 1000q)*
Source: Magyar Gazdasagkutato Intezet, p.8. **Notes:** *1000q (q mazsa = 100 kilograms, 1000q = 100,000 kilograms)

5. Analysis

Our goal is to try to determine the extent to which production of each sector affected hyperinflation and how hyperinflation affected production of goods in post-WWII Hungary. Before we can analyze the relationship between the two, we will first explore the hyperinflation and cost of living indices during the time period. Chart 10 shows the log scale cost of living, excluding rent, indexed to 1945. We chose to use indices that excluded rent because rent prices are sticky and do not inflate as fast and to the degree that other goods do. From this index, the highest calculated monthly rate of inflation is 1.97×10^{17} percent. After analyzing each sector and the total cost of living, we found that each correlated with the total cost of living at least .99999 and "Other Requirements" had a correlation of 1 with the total cost of living. It is clear that prices moved together and we cannot place the cause of hyperinflation to one sector's price increases.
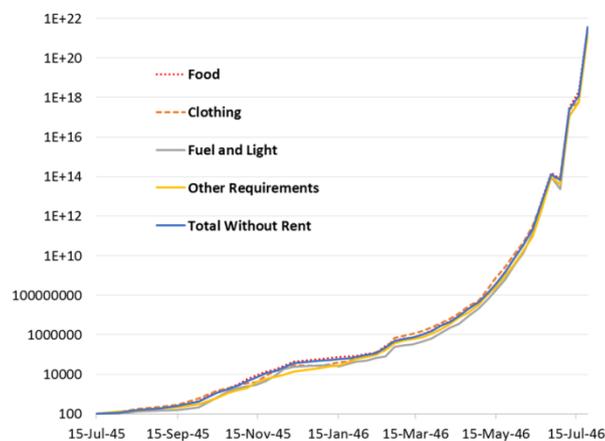

Figure 10. *Cost of Living, Excluding Rent (1945=100)*
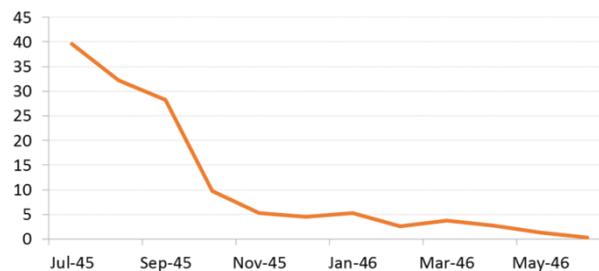
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Further looking into hyperinflation, we should explore the amount of notes circulating in the economy compared to a price index and the real purchasing power of the currency. Charts 10, 11a and 11b illustrate the high note circulation, its value indexed to 1938, and its real purchasing power. From these three, we can see that as notes kept on circulating, the currencybecame worthless. There was too much money in the economy for the amount of goods present, making it difficult to purchase goods because the currency was being devalued. By the end of the hyperinflation in July 1946, the addition of new currency barely made a difference to purchasing power.

In post-WWII Hungary, policymakers had two problems to deal with: hyperinflation and shortages of goods. Grossman & Horváth (2000) explore the decisions policymakers had to make: either encourage hyperinflation, or try to combat it by raising revenue and cutting note circulation (Grossman & Horváth, 2000). Ultimately, they argue that hyperinflation was chosen as a way to boost the economy and encourage production before the new currency was introduced.
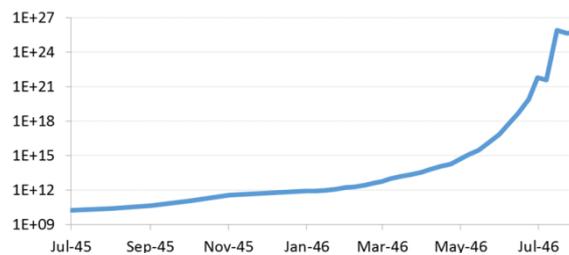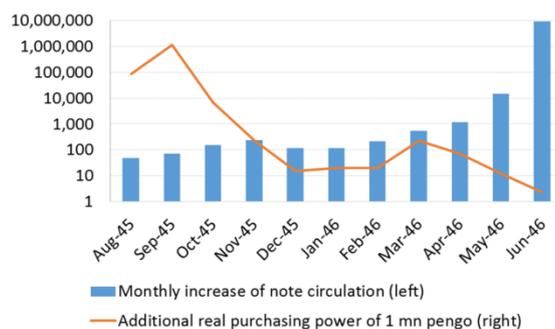

Figure 11a. *Nominal Note Circulation (Pengoes)*
Source: Hungarian General Creditbank, August 1946, Appendix I.

Figure 11b. *Real Note Circulation (1938=100)*
Source: Winkle (1947), p.184.

Figure 12. *Note Circulation and Real Purchasing Power*
Source: Winkle (1947), p. 184.

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It is important to note that even if policymakers decided to combat hyperinflation, it could have been inevitable from the amount of money circulating and the severe supply shock. As Grossman & Horváth (2000) explain, increasing the money supply in itself is a demand shock and can be thought of as a way to stimulate consumption. When there is high inflation, money loses value and thus people are more likely to buy goods. However, an increase in the money supply is not useful unless there are goods to buy. Thus, the government also needed a way to stimulate production. We must now explore hyperinflations effects and governmental policy effects on various areas of production. Recall from previously that coal, mining, and agricultural production, with a few exemptions, all experienced rising levels of output after 1945.

Whether for economic or political reasons, most industries post WWII in Hungary were nationalized and became state enterprises. However, only the mining industry and few power plants were nationalized before stabilization–that is, before hyperinflation ended (Ecker-Racz, 1954). Therefore, during hyperinflation, the government had to work both publicly and privately to encourage entrepreneurs, investment, and production. In order to tackle agricultural problems, major land reform took place. Land reform split up large estates and worked to give lower income-classes private land (Stowe, 2011). The government also gave out loans in private credit markets at interest rates that were not indexed to the cost of living, knowing that the payments would become worthless because of inflation, or possibly without the expectation that they would be paid back (Grossman & Horváth, 2000). State enterprises also received grants. The newly created Ministry of Reconstruction utilized the labor market for infrastructure and harvest purposes. Further, the Hungarian government involved banks to provide funds to entrepreneurs. This was done by paying banks to transfer money to producers. The central bank's discount rate was 3 percent, and accounting for the inflation that reached over 10,000 percent, the real interest rates became very negative (Grossman & Horváth, 2000). All were seen as a way to boost production.

Comparing industries, we see that all sectors made decent progress in getting back to pre-war levels. Chart 13 displays monthly coal and steel production, indexed to 1937-1938 levels. This evidence supports the view that the Hungarian government successfully steered hyperinflation in a way that could aid production, as claimed by Grossman & Horváth (2000), who report that raw material production and infrastructure recovered significantly.

They cite Fekete, when stating that railroads were at 90 percent, and metal and iron industries at 75 percent, of their prewar level by August 1946 (Grossman & Horváth, 2000). From Chart 13, we can see that coal production steadily increased, while steel production was more sporadic and actually did surpass pre-war levels, before coming back down at the end of 1947. Chart 14 displays production data for a wider variety of industries, although the data is of lesser frequency.

Figure 13. *Average daily production of coal and steel (1937-1938=100)*
Source: Adapted from Siklos (1989). **Notes:** *Data unavailable for steel production during October 1945 to December 1945
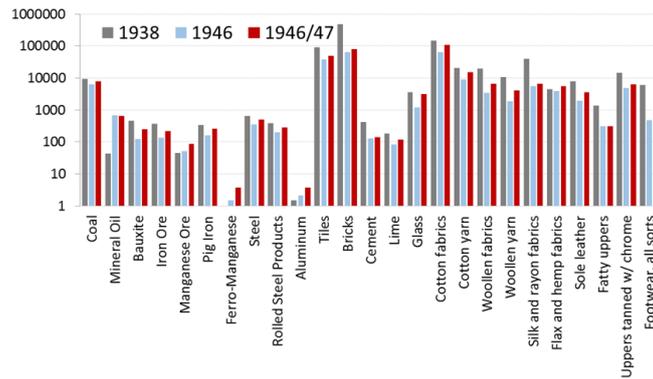

Figure 14. *Production per year (Log scale)*
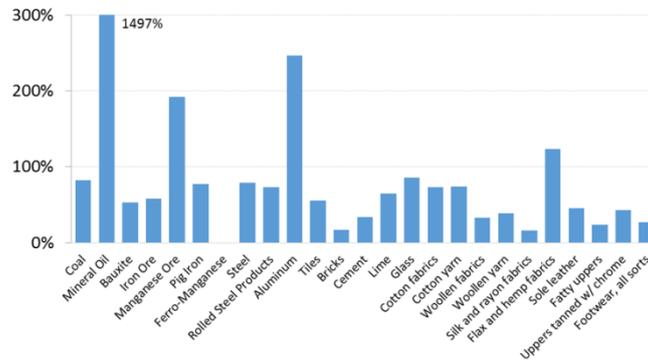**Source:** National Bank of Hungary, *Monthly Bulletin,* July-August 1947, p.182. **Notes:** *Chart numbers in various physical units

Figure 15. *Production in 1946/1947 (% of 1938)*
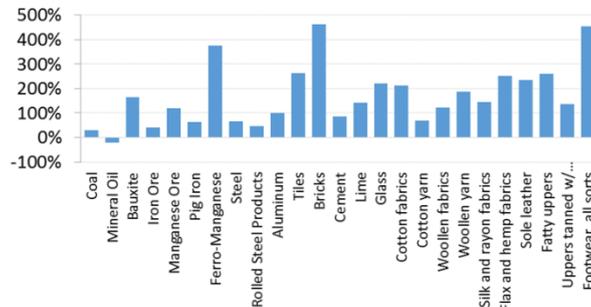**Source:** National Bank of Hungary, *Monthly Bulletin,* July-August 1947, p.182.

Figure 16. *Change in monthly production, August 1946-August 1947*
Source: National Bank of Hungary, *Monthly Bulletin,* July-August 1947, p.182. **Notes:** *Monthly data was only available for August in this context for comparing industry data

The National Bank of Hungary's *Monthly Bulletin* explains the data from Chart 14 in terms of percentage of each good since 1938. In order to analyze more simply, we turned these numbers into a chart. From Chart 15, the industries that recovered the most, and even surpassed 1938 production levels, were mineral oil (1497 percent), manganese ore (192 percent), aluminum (247 percent), flax and hemp fabrics (123 percent), glass (86 percent), and coal (83 percent). Chart 16 goes further and explores the difference in monthly production just for the month of August in 1946 and 1947. All sectors increased production between these months, except for mineral oil production.

Charts 15 and 16 omit agricultural production. Agricultural production was measured by consumption levels and quantities supplied to the market. The *Monthly Bulletin* noted that during the first year of the forint, the supply of food increased, while actual consumption of food items was below the quantity supplied. From estimated consumption of food, meat and fat consumption increased, while potato consumption decreased. Data collected on the quantity of food brought to the Main Market and the market halls of Budapest indicate that the total amount of wagons increased by 140 percent from 1945/1946 to 1946/1947. This amount, however, was only 36 percent of 1938/1939 levels. Table 2 shows the monthly amount of wagons brought to the market (Hungarian Monthly Bulletin, July-August 1947).

Table 2. *Food wagons*

	1938/1939	1945/1946	1946/1947
Total of the year	28,555	4,250	10,183
August	4,367	322	476
September	3,944	298	356
October	3,198	409	170
November	2,397	137	108
December	1,809	422	551
January	1,287	152	154
February	1,256	149	102
March	1,420	416	853
April	1,530	585	916
May	1,759	984	1,135
June	2,723	151	1,894
July	2,865	225	3,468

Source: National Bank of Hungary, Monthly Bulletin, no. 7-8, July-August 1947, p. 183

To get an idea of whether hyperinflation helped, hurt, or was largely neutral for production, let us compare Hungary to other countries that also experienced devastation from WWII. We will compare Hungary to Germany, because it was the main Axis power and suffered heavy losses; the other Axis countries in Europe; and some neighboring countries. Data come from the Maddison Project of GDP per capita, although data were not available for all years for all countries. Table 3 consists of calculations constructed from GDP per capita over different time periods, annualized to compare different countries' recoveries.

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Table 3. *Annual-ized change in GDP per person (%)*

	Hungary	Germany	Romania	Yugoslavia	Bulgaria	Italy	Greece
1938-1944		3.35			-2.24	-7.29	-13.57
1938-1945		-1.43			-4.67	-7.75	-13.92
1938-1946	-5.28	-9.65				-3.31	-7.90
1938-1948	-1.86	-5.51	-4.11	1.33		-0.30	-3.90

Source: Calculations from Maddison Project database (2013).

From1938-1948, annualized change in GDP per capita was better in Hungary than in Germany, Greece, or Romania. I chose 1948 as the endpoint because it was a few years after WWII, giving the affected countries time to recover. However, both Yugoslavia and Italy performed better than Hungary in the period. The other data available for Hungary allowed for a comparison between 1946 (rather than 1948) and 1938. The annualized change in GDP per capita for Hungary between 1938 and 1946 was once again higher than in Germany and Greece, but lower thanin Italy.

In summary, Hungary was in the middle of the pack. To say more would require more detailed structural investigation of the economies mentioned, which I did not do in light of the time constraints for this paper. It does seem that Hungary's hyperinflation did not greatly hurt the speed of the recovery after WWII. In fact, production across major industrial and agricultural sectors increased post WWII up to 1947.

As currency stabilization came closer, involvement by foreign powers increased. The Soviet Union helped through readjusting Hungary's reparation schedule and the United States purchased American surplus property as a way to give a line of credit worth $15 million to Hungary, as well as supporting Hungary for aUnited Nations Relief and Recovery Agency (UNRRA) program. The Soviet Union increased the repayment timeline for its loan from six to eight years, reduced late penalties, and reduced the amount of deliveries due in 1946 and 1947 (Ecker-Racz, 1946). With the extra help, Hungary was able to focus on stabilization efforts. In order to prepare for stabilization, Hungary began to hold merchandise and finished product, so that there would be goods to buy once the forint was issued (Ecker-Racz, 1946; Vas & Gonda, 1977).

6. Conclusion

From data on production across sectors, it is evident that Hungary's economy, despite hyperinflation, was able to recover from WWII. By 1948, GDP per capita was 83 percentof pre-war levels (Madison Project, 2013). Industries such as coal and railways had recovered to approximately similar levels. Comparisons of GDP per capita to nearby countries shows that Hungary seemingly had a better recovery than many. This, however, does not allow us to determine the extent to which hyperinflation affected their economy. As explained earlier, hyperinflation allowed payments on loans given out from the government to decrease in value, which may have encouraged production. Further, hyperinflation may have served as a demand shock to the economy, and along with other policies enacted by

the government, did not appear to hurt the economy as much as expected. In order to make this assertion, however, more data and analysis would need to be completed. Industrial production in other countries would serve as a good starting point for comparison.

Appendix

This section explain charts that were manipulated or required further calculations or omissions of original data. Unless otherwise indicated, no additional calculations were made. Tabs refer to the accompanying spreadsheet.

Chart 1 – "Other" category is a sum of handicrafts, commerce, finance and insurance, private households, cultural institutions, and others. This was done because national wealth for chart 1 was only given as a lump sum for all. Therefore, in order to find the war losses and their percent of national wealth, the categories were added for similar comparisons. The separate categories and their totals can be found on the accompanying spreadsheet under Tab 9.

Chart 2 –Tab 9.

Chart 3 –Tab 9.

Chart 4 – Tab 3.

Chart 5–Tab 9.

Chart 6–Tab 9.

Chart 7– Data on a log scale for chart. Chart 7 can be found under Tab 6.

Chart 8 – Data on a log scale for chart. Chart 8 can be found under Tab 7. Correlation function was used between both rows of data to find correlation.

Chart 9 – Reduction calculations are next to data, to find how much production of each mineral changed. Other than that, no further calculations or manipulations were performed. Chart 9 can be found under Tab 7 of accompanying spreadsheet.

Chart 10 – Numbers were manipulated to make data continuous and all indexed numbers on the same level. Exact manipulations are next to the columns that needed calculations on the spreadsheet. The data was not continuous because the high numbers of inflation led to new indexations of 1945 levels. For example, when numbers started to get high, the index would make 1945 equal 1 instead of 100. Simple multiplication was used to account for the discrepancy. The chart was also made on a log scale. Calculations for inflation numbers are beside the actual data. This was done through division of index of living, and then computing annual and monthly data. Further correlation numbers were calculated through the correlation function. Chart 10 can be found on Tab 10.

Charts 11a and 11b – Numbers were combined from two different sources that gave the same numbers. These sources are The Hungarian Central Creditbank and The South African Journal of Economics. Two separate charts were made for note circulation and the real value of the currency, since the two could not be superimposed. The two could not be superimposed because data on the real value of the currency was of a lesser frequency. Both have accompanying tables and can be found on Tab 11.

Chart 12 –Tab 11.

Chart 13– Tab 12.

Chart 14– Tab 15.

Chart 15 – Calculations were made by dividing 1946/1947 levels by 1938 levels to find the percent of 1938 levels. Chart 15 can be found on Tab 15.

Chart 16 – Calculations were made by finding the percent change in monthly production between August 1946 and August 1947. Chart 16 can be found on Tab 15.

Table 1a and 1b–For Table 1a, there were no additional calculations. Table 1a can be found on Tab 16. For Table 1b, only information on damaged or destroyed railways and their 1938 levels were used. Further, only a couple examples of capital were used because complete data was not available for all railway capital. Table 1b can be found on Tab 10.

Table 2 – No additional calculations for Table 2, which can be found on Tab 15. However, percent reductions for monthly data were calculated next to Table 2 for reference.

Table 3 – Table 3 was constructed from Maddison Project data on GDP per capita. First, percentage changes from different time periods of GDP per capita were calculated. Then, those data were annualized to compare rates across countries. Data wereomitted from the table if they were too spotty. The final Table 3 is in blue on Tab 14.

The following source was used to identify large numbers and the amount of zeros they carry via both the English and U.S. systems: "Names of Large Numbers." Wikipedia. Wikimedia Foundation, 16 July 2015. Web. 27 July 2015. [Retrieved from].

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