Analysis of Increased GDP Per Capita of Britain during the Malthusian Trap Period (1348-1525)

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ABSTRACT: Through the analysis of decreasing population growth rate in the Great Britain in the period of 1348 – 1525, after Black Death, this article shreds light on reasons for increased British GDP per capita. During this period of time, decreasing population lead to labor scarcity, lower agricultural output, which in turn lead to lower GDP growth rate? However, due to the sharp decrease in population, agricultural land per capita went up considerably, rent decreased, and farm tenants earned significantly more. Therefore, there is a close link between increased GDP per capita and decreased population.
KEYWORD: Population growth rate; GDP per capita; agricultural growth rate

1 INTRODUTION

During the time frame the article deals with, namely 1348 BC to 1525 BC, Britain witnessed massive and frequent outbreaks of Black Death, on account of drastic population increase of the previous period, intense relationship between human beings and land, and decreased resources per person. Black Death reduced the population greatly and put British economy into Malthusian Trap. This time frame of 1348-1525 is also called the Malthusian Trap Period. Through collection and organization of historical data, this article deals with the huge influence population had, as an important variable, on British economic growth rate, especially on GDP per capita growth rate. This article also manages to outline the reasons and features of decreased population and increased GDP per capita during this period. Data show that the growth of the British tariffs and wool textile industry were positively correlated, wool textile industry and sheep were positively correlated relationship, its value added is also increasing, namely, the upgrade of industrial structure, the higher high-end product value added. Such a British relationship between industrial structure upgrade, has been found a big GDP and improve the country's national income pattern.

1.1 *Data Analysis of British population, Economic Growth Rate, Agricultural Production Growth Rate, and Non-agricultural Production Growth Rate during 1348 AD and 1525 AD*

1.1.1 Explanation of Tables of British population, economic growth rate and agricultural production growth rate and Textile Export

This historical period, 1348-1525, is defined in this article as the Malthusian Trap period. To figure out the relationship between British population, economic growth rate, agricultural production growth rate and textile export during this period, using studies of works from both foreign and Chinese scholars, we collect, calculate and extract data regarding the above mentioned four elements to form six tables.

1.1.2 Data Comparison Table for British Population, Economic Growth Rate, Agricultural Production Growth Rate, and Non-agricultural Production Growth Rate (1348-1525)

Table 1 Comparison Table for British Population Growth (1348-1525) [1-7]
Event Window: 1348-1525
Place: Great Britain

No.	Period	Years	Data			Growth Rate (%)	
			From	To	Growth	Period Growth Rate	Annual Growth Rate
1	1348—1400	52	5000000	2100000	-2900000	-58	-1.65
2	1400—1450	50	2100000	About 2300000	200000	9.52	0.18
3	1450—1500	50	About 2300000	2800000	500000	21.74	0.39
4	1500—1525	25	2800000	2200000	-600000	-21.43	-0.96
6	1348—1525	177	5000000	2200000	-2800000	-56	-0.46

Table 2 Growth Rate of British GDP (1348-1525) [8] [9] [10]
Event Window: 1348-1525
Place: Great Britain

No.	Period	Years	Item	Data			Growth Rate (%)	
				From	To	Growth	Period Growth Rate	Annual Growth Rate
1	1300-1470 (unit: based on poinds in 1300)	170	GDP(million poinds)	4.66	3.5	-1.16	-24.89	-0.17
			GDP per capita	0.78	1.52	0.74	94.87	0.39
2	1500-1600 (unit: based on international dollar in 1990)	100	GDP(million international dollar)	2815	6007	3192	113.39	0.76
			GDP per capita	714	974	260	36.41	0.31

Table 3 Wheat Yields per acre Growth Rate [11-13]
Event Window: 1348-1525
Place: Great Britain

No.	Period	Years	Data (unit: bushel)			Growth Rate（%）	
			From	To	Growth	Period Growth Rate	Annual Growth Rate
1	1200—1450	250	8	8.5	0.5	6.25	0.02
2	1450—1500	50	8.5	9	0.5	5.88	0.11
3	1500—1600	100	9	11.5	2.5	27.78	0.25
4	1200—1600	400	8	11.5	3.5	43.75	0.09

Table 4 British Crop Yields as times of Planting Quantity (1348-1525) [14-17]
Event Window: 134815-25
Place: Great Britain

No.	Period	Years (approximately)	Mixed Crop Yield/Seeds			Growth Rate (%)	
			From	To	Growth	Overall Growth Rate	Annual Growth Rate
1	1350-1399～1400-1449	50	5.2	4.6	-0.6	-11.54	-0.24
2	1350-1399～1550-1599	200	5.2	7.3	2.1	40.38	0.17
3	1400-1449～1500-1699	100	4.6	7	2.4	52.17	0.42
4	1350-1399～1500-1699	225	5.2	7	1.8	34.62	0.13

Table 5 Average annual growth rate of woolen fabrics during Henry VII Period (1485-1509)[18][19]
Event Window: 1348-1525
Place: Great Britain

No.	Period	Year(s)	Data (bolt)			Annual Growth Rate (%)
			From	To	Growth	
1	1485-1486～1486-1487	1	57104	33732	-23372	-40.93
2	1486-1487～1487-1488	1	33732	47303	13571	40.23
3	1487-1488～1488-1489	1	47303	53308	6005	12.69
4	1488-1489～1489-1490	1	53308	58157	4849	9.10
5	1489-1490～1490-1491	1	58157	55664	-2493	-4.29
6	1490-1491～1491-1492	1	55664	54544	-1120	-2.01
7	1491-1492～1492-1493	1	54544	55163	619	1.13
8	1492-1493～1493-1494	1	55163	59511	4348	7.88
9	1493-1494～1494-1495	1	59511	60545	1034	1.74
10	1494-1495～1495-1496	1	60545	58398	-2147	-3.55
11	1495-1496～1496-1497	1	58398	57714	-684	-1.17
12	1496-1497～1497-1498	1	57714	62108	4394	7.61
13	1497-1498～1498-1499	1	62108	60460	-1648	-2.65
14	1498-1499～1499-1500	1	60460	75957	15497	25.63
15	1499-1500～1500-1501	1	75957	82109	6152	8.10
16	1500-1501～1501-1502	1	82109	86291	4182	5.09
17	1501-1502～1502-1503	1	86291	76054	-10237	-11.86
18	1502-1503～1503-1504	1	76054	75203	-851	-1.12
19	1503-1504～1504-1505	1	75203	68115	-7088	-9.43
20	1504-1505～1505-1506	1	68115	77845	9730	14.28
21	1505-1506～1506-1507	1	77845	83254	5409	6.95
22	1506-1507～1507-1508	1	83254	93597	10343	12.42
23	1507-1508～1508-1509	1	93597	92995	-602	-0.64
24	1485-1486～1508-1509	23	57104	92995	35891	2.14

Table 6 Percentage Change of British Agricultural Population [20-22]
Event Window: End of 15th century – mid-16th century
Place: Great Britain

No.	Period	Years (approximately)	Data			Non-agricultural labor(%)	
			From (%)	To(%)	Decrease(%)	Non-agricultural rate	Annual non-agricultural rate
1	End of 15th century—mid-16th century	70	90	80	10	11.11	0.17

2 DATA ANALYSIS AND CONCLUSIONS

Based on Table 1-6, we get Table 7 Comparison of average annual growth rate for population, GDP per capita, agriculture and non-agriculture output (1348-1525)

Table 7 Comparison of average annual growth rate for population, GDP per capita, agriculture and non-agriculture output (1348-1525)

No.	Item	Period	Annual Growth Rate (%)	Difference with Population Growth Rate
1	Population	1348—1525	-0.46	0
2	GDP	1300—1470	-0.17	0.29
3	GDP per capita	1300—1470	0.39	0.85
4	Agricultural productivity (wheat yield per acre)	1200—1600	0.09	0.55
5	Seed/yield ratio of four mixed crops	1350-1399~1500-1699	0.13	0.59
6	Woolen fabric export growth rate	1485—1509	2.14	2.60
7	Non-agricultural labor rate	End of 15th century ~ mid-16th century	-0.17	0.29

Sources: Data from Table 1, 2, 3, 4, 5, and 6.

2.1 *Data Analysis*

1. From 1348 to 1525, British population decreased by 2.8 million from 5 million to 2.2 million. The growth rate is -56%, and annual compounding growth rate is -0.46%.

2. From 1300 to 1470, the British national product decreased from 4.66 million pounds (based on prices in 1300) to 3.5 million pounds. The growth rate is -24.89%. Annual compounding growth rate is -0.17%. From 1500 to 1600, national product increased from 2815 million dollars (International dollars in 1990) to 6007 million dollars (International dollars in 1990). The growth rate is 113.39% and annual compounding rate 0.76%.

3. During the period from 1200 to 1600, British wheat yields per acre increased from 8 bushel in 1200 to 8.5 bushel in 1450 and again to 9 bushel in 1500. The growth rate for the period from 1450 to 1500 is 5.88% and annual compounding growth rate 0.11%. In 1600, it increased to 11.5 bushel. The growth rate for the period from 1500 to 1600 is 27.78% and annual compounding growth rate 0.25%. As for yields for four crops mentioned before, from 1350 - 1399 to 1400-1449, the annual growth rate was -0.24%; from 1350-1399 to 1550-1599, 0.17%; from 1400-1449 to 1500-1699, 0.42%. It tells us crops yield per acre hardly increased. It even decreased. However yields per capita increased.

4. From 1485 to 1509, annual growth rate of woolen fabrics was 2.14%.

5. From late 15th century to middle 16th century, the percentage of agricultural population decreased from 90% to 80%. Agricultural percentage was decreasing. Annual non-agricultural rate was 0.17%.

2.2 *Conclusions*

According to Table 7, Comparison of average annual growth rate for population, GDP per capita, agriculture and non-agriculture output (1348-1525) we draw following conclusions:

1. Annual population growth rate was the lowest. It was 0.85, 0.55 and 0.59 percent lower than GDP per capita, annual growth rate of wheat yields and annual growth rate of mixed crops yields respectively.

2. GDP per capital growth rate was 0.39%, which means in a period as long as 177 years and annual population growth rate of -0.46%, GSP per capital still increased by 0.39%.

3. From 1200 to 1600, annual wheat yield growth rate was 0.09%. From 1350-1399 to 1500-1699, annual mixed crops yield growth rate was 0.13%.

4. Annual woolen fabric export growth rate was 2.14%, which means the speed of development of British textile industry was faster than that of agriculture and population.

5. Average annual growth rate for non-agricultural population was 0.17%, which means British non-agricultural transition continued.

3 PATTERNS，FEATURES AND REASONS FOR GDP PER CAPITA GROWTH FROM 1834 TO 1525

3.1 *Patterns of GDP per capita growth*

During the Black Death period, British economic growth showed abnormal patterns. Population decreased while GDP per capita took off. Agricultural output in this period climbed up slowly at a rate of 0.09%, which was higher than that of population growth. Due to the negative growth rate of population, GDP per capita grew fast, while GDP decreased. This pattern of fast GDP per capita growth was still that of plantation agricultural style which relied on land. This growth pattern was not sustainable. It was a trough of agricultural society growth cycle, and a typical Malthusian Trap.

3.2 *Features of Economic Growth*

The British population experienced a -0.46% annual growth rate for as long as 177 years from 1348 to 1525. Population plummeted from 5 million to 2.2 million. This relieved the tense relationship between human beings and land, human beings and resources,

putting these back to normal. This also pushed GDP per capita and agricultural output up into growth patterns. GDP per capita rose above poverty line. This is the so-called Malthusian Trap: negative population growth with high GDP per capita growth. This is typical growth pattern of plantation focused agriculture. Negative population growth resulted in scarcity in agricultural labor, and this scarcity resulted in decreased agricultural output, which in turn led to decreased GDP growth rate. That of this period is still typical agricultural growth pattern.

3.3 *Influence of land per capita*

The fast growth rate of GDP per capita, 0.39%, seemed against normal agricultural societal growth pattern. However, this is a special manifest of the slow GDP per capita growth rate in agricultural society. The continuing growth of population and lack of growth in land and GDP per capita worsened the tense relationship between people and land. That at last triggered the Black Death, which reduced population drastically. Land per capita increased. Intense relationship between human beings and land relieved. Resources per capita increased. Intense societal relationship relieved. That was why GDP per capita increased during the Black Death Period. The price of this fast growth was negative population growth. Decreased population resulted in decreased or negative growth in GDP and land output, while GDP per capita increased.

3.4 *Influence of decreased population*

We can see that between 1348 and 1525, British population annual compounding growth rate was -0.46%, that between 1300 and 1470, GDP annual compounding growth rate was -0.17%, that GDP per capita annual compounding growth rate was 0.39%, and that between 1350-1399 and 1400-1449, average annual growth rate of yields for the four mixed crops (wheat, naked barley, barley and oats) was only -0.24%. GDP annual compounding growth rate was 0.29% higher than that of population. That is to say, the negative growth rate of -0.17% for GDP was mainly caused by negative population growth. Negative growth of population and scarcity of agricultural labor lead to decreased land output, which in turn lead to decreased GDP growth.

3.5 *Summary of reasons for GDP per capita growth*

In this historical period, GDP per capita increased considerably. The major reasons are: on the one hand, decreased population increased land per capita. This decreased rent and increased income of farmers. On the other hand, the development of sheep cultivation, especially that of woolen textile industry brought about higher production rate. The new industries had 3 times production rate of plantation. This high rate increased income per capita as well.

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