Causes of the British Industrial Revolution

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Abstract

The Industrial Revolution happened in Britain because by the 19-th century the eternal problem faced by humankind, i.e. the problem of hunger, had been resolved on a local scale.

Thanks to a unique combination of factors, Britain just overtook the other West European countries (for a short period of time in historical terms) in the understanding that the value of food "depreciates".

Key words: British Industrial Revolution, malthusian trap, international trade

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Introduction

Gregory Clark (2013) in his book «Farewell to Alms» said: «There are not two scholars who are of the same opinion as to the causes of the (British) Industrial Revolution…». Speaking at the economic forum in Moscow in 2013, Jack Goldstone (2013) referred to a similar example. He said that he had asked six scholars he knew to tell him what they thought the causes of the British Industrial Revolution were and had got six different answers.

At the same time, the Industrial Revolution in Britain is one of the greatest conundrums in history and the unraveling of this conundrum should help understand the phenomenon of economic growth as a whole. It may well be, though, that the solution of this conundrum is not so difficult: it is just that, at that time, humankind approached the resolution of its eternal problem, the problem of hunger.

Let us recall lines of Nekrasov's poetry: «There is the tsar in this world, that tsar is ruthless, his name is hunger». If we are to talk in the language of economists, what is meant is the «Malthusian trap». It is called so after Thomas Malthius (1766-1834), who claimed that the population was growing faster than production of food. And this periodically caused shortages of food, or to put it bluntly, resulted in hunger. That led to contraction of the population both due to hunger and hunger related disasters, i.e. wars for food resources; disease which was quicker to «carry off» people weakened by hunger and starvation, etc.

The importance of exiting from the «Malthusian trap» for economic development is underlined by many economists (see, for example, Galor and Moav, 2002; Clark, 2013). The "Expert" magazine (published in Russia) also touched upon this subject (see, for example, the article by Prof. Popov «Sweat, Blood and Institutes» http://expert.ru/expert/2012/19/pot-krov-i-institutyi/).

It Is Not Always that a Rise in Productivity Takes Care of the Hunger Problem.

Besides, the above mentioned authors (just as many others) get caught in a kind of snare themselves when they say that one can break out of the Malthusian trap by increasing the rate of savings (Popov), by amassing human capital (Galor), by increasing productivity in industry, etc. ***But it is impossible to deal with the food problem without food itself!***

In the closed economy (in which there is no trade with others), which cannot provide enough food for itself, increasing the productivity of the manufacturing industry (industrial sector) does not help overcome hunger at all. It is obvious that if there is no bread, one cannot replace it with fabrics as fabrics are no good to eat. Otherwise, probably, there would not have been any Bengali weavers dying in millions in the 19-th century.

There are only two ways out in combating hunger: either the economy is increasingly supplied with the food produced by the economy itself, or the economy must be open and import food. This is exactly here that the worst bottleneck is: ***it is impossible to import food, if around us (i.e. in other countries) hunger rules supreme and there is no surplus food***.

This article is making an attempt to show that it is precisely the resolution of the food problem simultaneously in a number of countries in Europe and the U.S.A. that created the above mentioned food surpluses and enabled the British Industrial Revolution to happen. It also discusses another trap, i.e. «vulnerable wealth» ("defenseless wealth"), which also needed to be avoided for the Industrial Revolution to get underway in Britain.

Two Traps.

Below we discuss the two traps which humankind came across on its path of development and possible ways of avoiding these traps.

Methods of Exiting From the «Malthusian Trap».

Let us now consider the methods of exiting from the «Malthusian Trap», which the humankind has tried out throughout its history.

1. Increasing the productivity of food «procurement».
2. Reducing the population's pressure by spreading surplus population over unoccupied land or the land captured from others.
3. Conquests (loot, contributions paid by subjugated peoples)
4. Survival by producing industrial goods
5. Survival through trade.

Increasing the Productivity of Food «Procurement». One can say that the most graphic example of this kind is the so called «Neolithic Revolution», when people in certain regions of the world passed from the so called acquiring form of economy (hunting, gathering) to «producing» form of economy (agriculture, cattle breeding). That resulted in the number of people who were able «to live off» one unit of area (for example, one hectare) increasing dozens of times. The result was, more often than not, temporary. The number of people increased while productivity of a hectare of land did not grow at the same pace. It will be explained why growth of the population is critical to other exits from the trap.

Extensive Growth (New Unoccupied Territory). According to the tentative estimations by geneticists during the times of the so-called «mitochondrial Eve» and «Y-chromosomal Adam» the population on Earth was very small. Some people believe that at some point in time the population of our ancestors was a mere 200 individuals. That provided a good opportunity for one more exit from the «trap»: relocation of the «surplus» population to free unoccupied land. Of value were not only the fields for agriculture, but also the meadows for livestock to graze and other resources (water, forest), which allowed food to be produced.

But subsequently people still had opportunities to populate new territories. In the history of Russia and the USSR, there were two last major episodes of such kind. The first episode was Stolypin's reforms (Stolypin – Russian Prime Minister, 1906-1911) . They were instrumental in relocating people from the overpopulated areas of the European part of the Russian Empire to Siberia and the Far East. During the times of these reforms, my great-grand-father whose name was Efrem Eremenko moved from the Ukraine to the Primorsky Territory. Therefore, I studied the history of migrants from the Ukraine to the Primorsky Territory. It turns out that this process had got underway long before Stolypin. Massive relocation of Ukrainians to the former South Usuriysky Territory began in 1883, when regular massive relocation of peasants by sea from Odessa to Vladivostok by steamer was organized. The second episode involving settlement in undeveloped lands goes back to the USSR when a campaign was organized to develop the virgin lands in Kazakhstan.

Let me reiterate again that the most successful in populating waste and empty lands were the tribes/peoples who were multiplying in a «surplus» manner (in the opinion of the advocates of birth restriction). In other words, the number here was beginning to play a role.

Conquest of somebody else's lands and the ousting of neighbors. If the surrounding territories were occupied by other tribes or people, in order to take them over, it was necessary to oust them from these lands. Exit from the Malthusian trap, just as in the previous example, is therefore achieved as a result of reducing the «pressure» brought to bear on the area which was a source of migrants.

Given that everything else was equal, the more numerous tribes were also successful in ousting other tribes. In other words, the number of people became central to it. This is exactly where lies the important mistake made by those researchers who view growing population almost as an absolute evil.

In this method of exiting the trap, one can isolate, among others, two distinct scenarios where in each of them the number of people is important.

1. «Those who are lagging behind» are ousted. Those being ousted are using less productive technologies. For example, gatherers/hunters are ousted by land cultivators and cattle breeders. Examples to illustrate this point spring to mind immediately. A significant period in the history of the U.S.A. was the ousting of Indians (hunters/gatherers) by European migrants (land cultivators/cattle breeders).
2. «The advanced ones» are ousted. Those who are being ousted use more productive technologies. But these technologies either are not transformed into (a) population growth (if these technologies are not related to production of a large quantity of food, and are related to, for example, pottery making, weaving, etc.), or (b) do not provide military protection. The most graphic example of this type is the downfall of the Western Roman Empire under the blows dealt by barbarians. Thus, for example, the article by Prof. Popov referred to above mentions the following logical sequence: «Reduction in population => shortage of warriors => defeats in wars (Greece, Rome, Byzantium)». Below we shall consider this as *«defenseless wealth trap»*.

Conquests. From the previous method this one differs in the fact that other people's territory is not populated by conquerors but is only used as a source of gain. Here we talk about plunder and/or imposition of taxes. Thorstein Veblen, in his famous work "The Theory of the Leisure Class" explains very aptly why conquests (predatory actions, according to Veblen) came into being and why they had a luster of «valor and glamour», i.e. were prestigious.

The most prominent historical example of such a strategy is the Genghis Khan Empire. Vast territories of modern Russia, China, other countries were conquered by Genghis Khan and his descendents. But more often than not the population was not ousted, it is just that taxes were imposed on them. The history of Ancient Rus and Russia abounds in attacks and raids by other nomads (Pechenegs, cumans, the Crimean Khanate), whose aim often was not to control the territories, they just grabbed food, valuables, and took away captives into slavery. Besides,

conquests were not a specific feature of «barbarians» or nomads only. As a matter of fact, any slave owning civilization is based on conquests. To celebrate the most successful conquerors in Ancient Rome, triumphal arches used to be erected, through which winners gloriously would make their solemn entry, multiple carts with loot and captured goods would be brought in as well as captured slaves would be led in.

In what way is it relevant to the exit from the Malthusian trap? It is very easy. «Excessive» population ceases to be such and is used to «produce» assets by capturing them. While the captured goods help resolve the «food» problem faced by the conqueror (and not only the food one).

Production of «non-food» goods. In the previous method, excessive population is used for conquests. But it can be also used for creative, productive activities. Part of the population (and in the extreme case, almost all the population of a whole state) may participate in the activities unrelated to production (procurement) of food. It may be focused on production of some other goods, commodities and exchange them for food in the process of trading.

A good example is the Venetian Republic of the medieval times. Antonio Serra (1613/1953), in his treatise dating back to the year 1613 shows that the Venetians who did not have large agricultural territories, lived a wealthier life than the Neapolitan Kingdom rich in bread. And this happened, among other things, due to a large number of and development of artisan crafts. Venetians were known to make mirrors and many other products themselves which enjoyed a huge demand in Europe. For example, Venetians learnt and improved the manufacture of soap which, prior to that, had been imported from the Middle East. They came to provide the whole of Europe with soap. Genoa, and subsequently, Holland also were famous for their goods.

Industrial goods were highly valued. It is common knowledge what a lucrative deal the Dutch struck when they bought the Island of Manhattan from Indians for (industrial) goods with a total value of several dozens of guldens. This example goes to show that industrial goods can be transformed into resources, including food.

The general practice of both the Venetians and the Dutch was to resort to imports in order to deal with food problems, which were favored by the revenues they generated from trade and which proves that this method of exiting the Malthusian trap was at a high level of development in their case.

At this point it is worth pointing out that ***the method of exiting the Malthusian trap by producing non-food goods is intimately connected with trade (exchange) with other countries***. The invariable condition is the existence of trading routes and best-seller goods to trade for food. Central to the exit from the «Malthusian trap» is also ***the availability of food in the countries which are trading partners. This is a very crucial caveat,*** which many researchers tend to overlook. Below we shall consider this point in greater detail.

Trade. When we were reviewing the previous method, we already mentioned trade, but as an activity ancillary to the principal one, i.e. industrial activity. Here what we mean is the trade per

se without any linkage with production. Back in olden times, countries or cities situated at the intersection of important trading routes or possessed of means of delivery (for example, the Venetian Fleet in the Mediterranean trade) became fabulously rich as a result of operating intermediary trade between different territories.

The whole of the Middle East, for many a century, reaped huge revenues from intermediary trade between Europe, on the one hand, and India and China as well as other Asian countries, on the other hand. Indicative of the power of the states located in this region is the fact that in the relatively recent year 1683, the troops of the Ottoman Empire laid siege on Vienna, while the entire Balkan Peninsula belonged to this empire. Great dependence of the region on trade is proved by the fact that the countries in this region began to lose influence and power when the Europeans had discovered a sea route to India, to the islands of «spices» and to China as well as had won supremacy at sea.

Some countries solved the food problem primarily at the expense of trade. But just as in the previous case (production of “non-food” goods) they depended on the availability of food surpluses of their trading partners.

Defenseless Wealth Trap.

So, we have seen the whole arsenal of tools which have been used at various times in order to break out of the Malthusian trap. But now is just the right time to think of how important the issue of safety, survival, the skill to defend oneself (or the skill to attack) is. How to avoid getting into the «defenseless wealth trap»?

Defense by number. Some books portray population growth as an evil, a negative phenomenon, which prevents you from getting rich, raising your level of well-being. But everything in this world happens for a good reason. If we were to ask a scientist who is a biologist (I recommend that you read the book «The Selfish Gene» by Richard Dawkins, for instance), why this or that strategy of behavior repeats itself many times, he would reply to us that this strategy is likely to lead to survival. Survival! This is the key word which characterizes the importance of the number of people!

Have there been, in history, groups of people who were able to regulate their number and to use this for «per capita» well-being to grow ? There must have been such groups. Do we know much about them? I fear that we know pretty little about some of them, because the majority of these groups (tribes or peoples) sank into oblivion under the blows dealt by the less wealthy but more numerous neighbors. As was mentioned above, Vladimir Popov in the article «Sweat, Blood and Institutes» adduces the example of Ancient Greece, Ancient Rome, Byzantium as the states which had suffered from insufficient population, and hence a small number of warriors, and fallen under the blows delivered by more numerous enemies.

There is such a sad expression: «The pedestrian is right but dead». If we paraphrase this subject to what was said above, it will say the following «the people were rich but they are no more». This is a typical «defenseless wealth trap».

And vice versa: many nations have not been so easy to conquer. And even in the case of them, at a certain historical phase, becoming dependent on other countries, these nations did survive thanks to their numerous population (India, China).

One can also emphasize a certain economic aspect: reduction in the specific costs to maintain the army. This is clear from a simple example: given everything else is equal, supporting an army of 100 thousand warriors would be less of a burden on the shoulders of a nation numbering 5 million people and a greater burden on a nation with a population of 1 million.

Defense by skill. Every Russian probably knows the maxim attributed to Suvorov to the effect that at war it is not the number that counts, it is the skill. Skill manifested itself in new tactics of genius (use of chariots in Ancient Egypt, Greek phalanxes, Roman legions, etc.). It can be referred to as the *organizational advantage*. However new types of weaponry, i.e. the *technological advantage,* causes the balance of forces to change accordingly. Thus, the advent of artillery rendered Constantinople defenseless before the Turkish troops. For the same reason, fortress walls and fortified castles lost their role. The emergence of fire arms rendered knights' armor useless. These two factors sometimes combined: thus, for instance, Genghis Khan's Mongols employed new tactics of waging a battle (organizational advantage), but it was based on technology: their bows had a shooting range unparalleled at that time (technological advantage).

In legends and real history there are many examples showing how the «skill» beats «number». One of them is the legendary battle fought by 300 Spartans against the numerous army of Tsar Xerxes, and a more recent and closer to the modern times use of machine gun against American Indians and Zulus.

Let us note that some time passed and these successful tactics were often adopted by new (or old) adversaries, or successful methods of counteracting them were found. With technology level being equal, the number or strength of the army recovered its importance.

«Peaceful stand-off». Even if two peoples live in the same territory and never have any conflicts, in a peaceful «genetic stand-off» (let us again refer to the book by Richard Dawkins «The Selfish Gene»), «the winner» will be the nation who has higher population growth rates.

Let us study an example. Suppose, at some point in time, the population of two tribes in one closed territory is the same (50/50). These tribes co-exist peacefully. However, the average number of surviving children per family in one tribe is two (simple reproduction), while in the other tribe it equals four (expanded reproduction). A simple estimate shows that in two generations only (grandchildren) 80 percent of the population will be accounted for by the people of the second tribe (80/20 ratio). While in 10 generations, the ratio between the tribes will be approximately 99.8/0.2.

More successful in the natural selection proved to be those who (a) have managed to provide enough resources (food resources, first of all) for population growth and (b) have not opted for

wealth when faced by the choice between the number of people and wealth. That is, ***oddly enough the winner is the one who tends to go into the «Malthusian trap»***

Natural protection. Mountains, rivers, straits, seas, since time immemorial, have been borders between tribes and nations, because they served as natural obstacles on the conquerors' way. Existence of such hurdles would have helped a great deal in the fight against conquerors. Lack of natural defense frontiers often used to make a territory unattractive for settlement. In the territory of the Russian Empire there was the so-called «steppe belt», which, for a long period of time (until the times of Catherine the Great, i.e. the 18-th century) was at the mercy of nomads. For quite a while no active settlement took place here as it was «open to all winds» and provided little natural protection.

And, vice versa, insular or peninsular situation (Venice built on the islands; Constantinople boasting a robust protection from the sea), especially if good naval forces were available (here we are dealing with the technological factor again) assisted a great deal in warding off adversary attacks. As natural protection we cannot fail to mention the fact that Russians were often helped by "General Frost" –Russian winter (in their wars against Napoleon or Hitler, for that matter).

How Did Britain Avoid the Two Traps.

Thus, above we have listed different methods tried by humankind to exit from the Malthusian trap. While we were about it, we noted that very often those nations who chose wealth between population and wealth, were wiped off the face of the Earth by more numerous adversaries in their military stand-off or peaceful «genetic» competition.

And now let us pass over from general discussions to Britain herself. It may appear to be a wonderful coincidence, but ***Britain, before the Industrial Revolution, in order to exit the Malthusian trap, was using practically the whole arsenal of means listed above!*** It is precisely this holistic use of all the means that enabled Britain to pull herself out of this trap.

The key success factors, from military perspective, were Britain's insular position and its supremacy at sea, which helped defend the country from conquest. ***The key factor, from economic perspective, was the agrarian revolution, which incidentally occurred not only in Britain herself, but in other countries, too, which allowed Britain to obtain food in exchange for industrial goods***. Let us now examine both the military and economic aspects in greater detail.

Britain and the Defenseless Wealth Trap.

As is known from the history of Britain, the insular position does not, at all, guarantee a hundred percent protection from attack or invasion. A case in point is the numerous raids by the Vikings and the Norman invasion of England by William the Conqueror. For the first time, England felt strong at sea in the battle with the Spanish Invincible Armada (1588). Indeed, the weather was a history making factor as the Spaniards lost most of their Armada due to bad weather and due to their lack of knowledge of Gulfstream.

But that was not England's final victory; after this England just started to feel its strength at sea, and hence some kind of protection from invasion. The fact that it was not their final victory clearly follows from the hands down defeat suffered by Francis Drake who had embarked on a counter campaign («Anti-Armada»). The English still had to beat the Dutch who, at that time, ruled supreme at sea (1672-1675), and then win the famous Trafalgar sea battle (1805). That saved the British from the invasion by Napoleon's 180-thousand men strong army standing ready to cross the English Channel and which was quite enough to vanquish Britain. Then they still had to stand up to the «Continental Blockade», organized by Napoleon, hindering trade between Europe and Britain. It was only after that (1815 until the end of the Napoleon wars) that the British were able to feel relatively safe. In my view, in many respects, thanks to this sense of security that they had developed, in Britain a drastic acceleration of industrial growth set in during 1800-1820 rather than during any other period (different scholars give different dates for the beginning of the «explosive» growth during the Industrial Revolution, Reinert (2011) dates the start of the Industrial Revolution as the year 1817).

However, the last trial and tribulation was in store for the English quite recently in historical terms, and that was during World War II. Nazi Germany did not have enough military capability for ground invasion, but German U-boats were so successful in torpedoing deliveries of food to Britain, that it resulted in a real food crisis on the island. Since at that time, approximately three quarters (and for some kinds of food, up to 90%) of food supplies were imported into Britain. This caused food rationing, the organized plowing of pastures to be used for sowing grain (bread started to be more important than meat).

Let us make some intermediate conclusions:

1. Britain, owing to its geography (insular position) and technology (advantage at sea), managed to avoid the «defenseless wealth trap», the scourge or bane of many rich cities, countries and nations before Britain, which were conquered by the enemy.
2. What is important is that this was done in many respects thanks to the technological advantage, i.e. it did not require a large number of people (which is important for the economic aspect of exit from the Malthusian trap).
3. Let us note as well that Holland, the prior technology leader,
    a. unlike Britain, was not in a position to feel secure and safe even at the time of the peak of its prosperity, as it was open to invasion from the continent.
    b. was not so large as Britain (i.e. the size does count!)

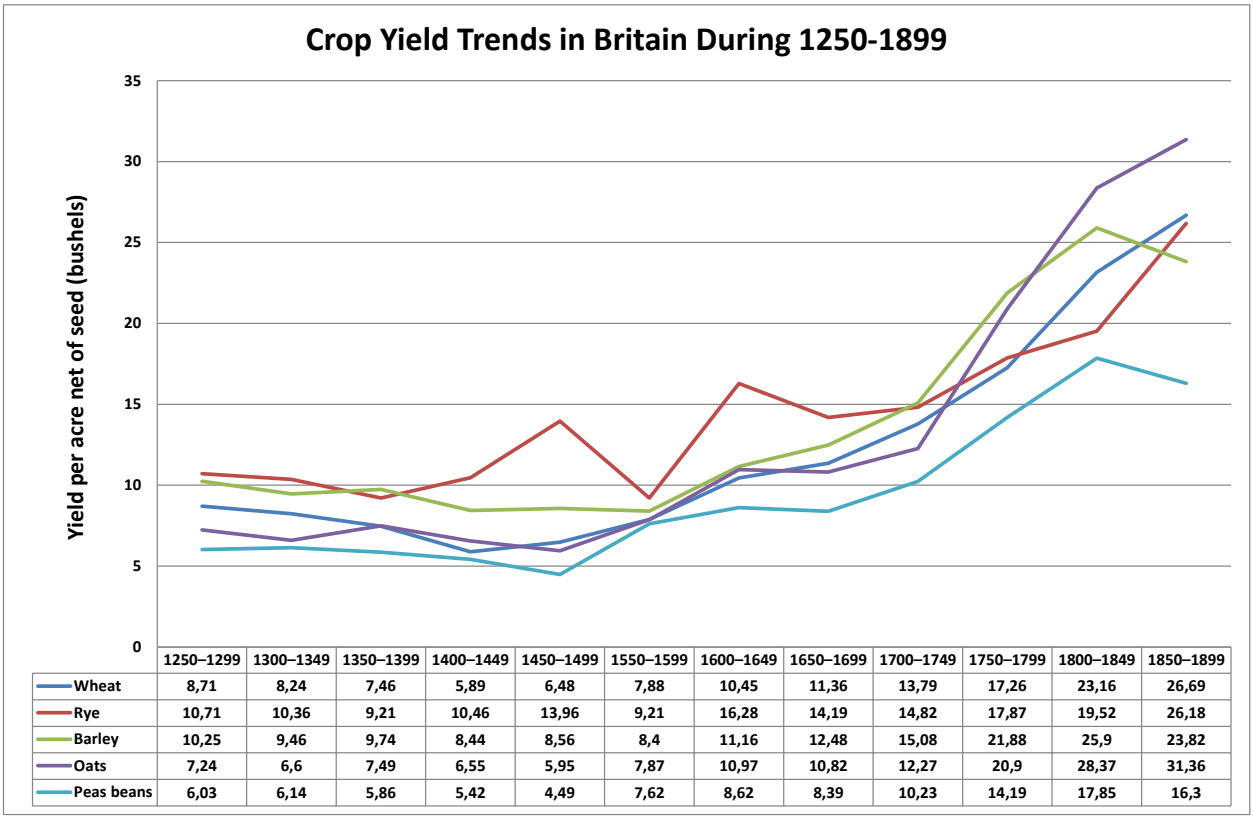
Now we shall consider the economic and demographical aspects of Britain's exit from the Malthusian trap.

Britain and the Malthusian Trap.

Above we have listed the methods practiced by humankind throughout its long history aimed at dealing with the problem of hunger (to exit the Malthusian trap) and related to economy or demography. Let us consider how these methods were used by Britain.

Productivity of Agriculture. However this may be surprising to many, but the most trivial exit from the Malthusian trap, namely an increase in productivity of agriculture (or to put it in broader terms, food production), had become possible by 1800. Due to many improvements and discoveries made during the 18-th century and earlier, unheard-of growth of crop yield became possible.

Fig.1. Crop yield of agricultural plants in Britain before the Industrial Revolution went up noticeably.



	1250–1299	1300–1349	1350–1399	1400–1449	1450–1499	1550–1599	1600–1649	1650–1699	1700–1749	1750–1799	1800–1849	1850–1899
Wheat	8,71	8,24	7,46	5,89	6,48	7,88	10,45	11,36	13,79	17,26	23,16	26,69
Rye	10,71	10,36	9,21	10,46	13,96	9,21	16,28	14,19	14,82	17,87	19,52	26,18
Barley	10,25	9,46	9,74	8,44	8,56	8,4	11,16	12,48	15,08	21,88	25,9	23,82
Oats	7,24	6,6	7,49	6,55	5,95	7,87	10,97	10,82	12,27	20,9	28,37	31,36
Peas beans	6,03	6,14	5,86	5,42	4,49	7,62	8,62	8,39	10,23	14,19	17,85	16,3

Source: Apostolides et all., 2008

As is evidenced by the diagram, the crop yield of wheat, for example, grew from 10.45 bushels per acre during the first half of the 17-th century up to 23.16 bushels per acre during the first half of the 19-th century, i.e. a 2.2 fold increase. This growth took place for all the main crops.

There are data available that also indicate growth of the area sown (Apostolides et al, 2008). Between 1600 and 1800, the sown areas increased from 6.23 mln. acres up to 8.4 mln. acres, 35% up. The number of draw animals increased which increased the power per worker ratio of agriculture. The less effective bulls were replaced by horses. The number of head of meat and milk cattle, sheep, pigs increased.

Quite a reasonable question comes up: what was the growth trend for the population? The Malthusian trap does not deny growth of agriculture productivity as such, does it? The trap lies in the fact that per capita provision is not growing, since the whole effect «is eaten up» in direct and metaphoric sense by the increased number of people.

Between 1600 and 1800, the British population more than doubled from 4.11 mln. people up to 8.62 mln. people. At the same time, the rural population did not grow so significantly, and during the period between 1600 and 1700, it even diminished. To put it simply, whereas in 1600, approximately 3 mln. rural inhabitants provided food to 4 mln. people, in 1800, the same 3 mln. rural inhabitants provided food to 8.6 mln. people.

Thanks to growth of agriculture productivity and imports (the important role played by imports will be described later), Britain's per capita provision with food was invariably going up. Thus, for example, in 1600, it amounted to 1153 kcal. per capita per day according to Apostolides, in 1800 – 1627 kcal.,and in 1850 – 1713 kcal.

So, we can see that Britain was well placed to avoid the Malthusian trap due to swift growth of agriculture productivity. But this is not enough to explain the «explosive» nature of the Industrial Revolution. Therefore we shall continue with our investigation further. But let us make an important point: similar agrarian revolution was taking place in other countries, too. As a result of such revolution, as well as due to extensive growth of the tilled lands (primarily, in Russia and the U.S.A.), other countries came to have special «surpluses» of food (or, at least, a potential ability to produce such surpluses), which could be traded for the goods offered by Britain.

Reducing the population pressure through migration. The English had colonies. There is no need to look for special numbers to characterize the scale of exodus from the country. But the fact that emigration from Britain did exist, is obvious. By 1776, the number of migrants (let us note, not from Britain only) and their descendents in North America was sufficient for the United States to declare and stand up for its independence. While among the British colonies, there were still Australia, New Zealand, Canada, India, some other countries.

Conquests. Excises, duties, taxes charged to the colonies were a notable source of revenues for the British Empire. It was exactly the discontent with high duties imposed on the colonies that served as a initial impetus driving the conflict between Britain and its North American colonies which led to the formation of the U.S.A.

This can be well compared with the imposition of tax on other peoples, if we are to talk about the so-called «non-immigrant» colonies (such as India, where the backbone of the population was aborigines while the English who were not numerous at all were performing military and administrative functions).

For the so-called «immigrant» colonies (such as Australia or Canada, where the backbone of the population was former Europeans and their descendents), the term «conquests» may sound inaccurate, since taxes were collected from the subjects of the British crown. But the fact that these taxes were a source of revenues for the metropolitan country is beyond doubt.

Apart from taxes, there were pure «captures» of trophies. It is not for nothing that a large number of ancient artifacts from India, Egypt and other countries are kept in the British Museum. Another part of the loot, which was not of any museum value (gold, silver, etc.) could

well have been used, if necessary, to resolve the «food» problem. One can mention the capture of French, Spanish, Dutch and other ships in sea battles as ships were not inexpensive. For example, in the famous Trafalgar battle, the British did not lose a single ship while they captured a huge number of ships from the united Franco-Spanish fleet.

Trade. Britain could have had and did indeed have huge revenues from trade. What is meant is trade per se, without «blending» in the country's own production. Any goods purchased in colonies and sold in Europe generated an additional revenue which allowed food to be purchased overseas or allowed Britain to simply have a safety cushion in the event of food crisis. Britain was in a position to do that due to its enormous fleet, its footprint (trade) in different regions of the world.

It is also important to emphasize the military aspect discussed above; Britain not only used the trading routes, but by virtue of its military supremacy it was capable of defending these trading routes as well as block competitors' attempts to usurp advantageous trading flows.

Manufacture of non-food (industrial) goods. However, the real «godsend» opportunity for Britain's quick rise was the capability to sell industrial goods.

The pivotal ***advantage of all the trading nations is good knowledge of the market situation. Better than others they know what is in demand and what exactly can fetch beneficial prices***. Serra, back in 1613, pointed out that «considerable trade promotes and improves the means consisting in multiple artisan crafts, while multiple artisan crafts and their development improve and promote external trade». Nowadays, this is called knowledge of the markets, marketing. It is precisely good knowledge of the markets that allowed trading nations not only to successfully resell goods, but also, when an opportunity presented itself, to direct the lucrative trading flows onto themselves by becoming a manufacturer. This way the English, knowledgeable about the business, entered the fabrics market as a producer, having substituted an enormous quantity of textiles imported by them into Europe from India, China and other countries.

Several illustrations of the benefits of exchange obtained by the English are adduced by Clark. «…English sailors who, in 1767, reached Tahiti on the ship Dolphin, found that the community on this island were not familiar with metals. Tahitians valued the European iron so much that a common 3 inch nail initially could be bartered for a 20-pound pig…»

But the following question arises: why indeed it was in the case of the English that success with barter led to the Industrial Revolution, whereas in the case of the Venetians, Dutch and others it did not? The answer, to my mind, is simple enough: all the predecessors did not have the complete arsenal of all the methods of exiting the Malthusian trap which Britain had. And they did not always have a capability to defend their position. «Any revolution is worthwhile only then, if it can defend itself» (Vladimir Lenin). However odd it may seem, this is the case with the Industrial Revolution, too.

However, there is one more circumstance which is underestimated very seriously, i.e. this is the need for availability of food surpluses in other countries!

Agrarian Revolution and Its Key Influence.

Productivity is no solution without food. Here is a very important point which often escapes notice. Many authors say that it was precisely the productivity growth that enabled Britain *to pull itself out of the Malthusian trap*. But that is *simply impossible without sufficient food supplies*!

As we have already mentioned above, in the closed economy, which does not provide itself with enough food, increased productivity of the manufacturing industry (industrial production) cannot help to overcome hunger. It is clear enough, isn't it that if there is no bread, fabrics cannot replace it, one cannot eat fabrics.

There are only two ways out: either food self-sufficiency increases, or economy must be open and import food. And here comes the narrowest bottleneck: ***it is impossible to import food if hunger is king around us (i.e. in other countries)***.

Venetians are known to have been very dependent on food supplies. Here is, for instance, a quotation from Wikipedia: «The reign of Lorenzo Tiepolo (one of the Venetian Doges) was not successful, at the time famine hit Venice, while the neighboring cities refused to supply bread to Venice».

Massimo Montanari (2009) gives a very vivid description of the situations when famine was advancing and how this affected the city dwellers. «For urban population, the times of famine meant *carum tempus*, «times of high prices», and this dependence on the market … made the position of city residents more precarious compared to peasants, who were directly connected with means of (food) production». In the most difficult years, city dwellers were forced to go to the countryside, in order, in exchange for the valuables they had, to obtain some kind of food, sometimes, they would chase away the city poor from the cities, i.e. the «extra mouths» that had to be fed.

Europe «has eaten enough». If we are talking about the causes of dramatic boost rather than about just the causes of growth which the British Industrial Revolution represented, the resolution of the food problem in Europe by the year 1820 was the key prerequisite of this growth.

Arguably outbursts of famine did happen later. The Irish famine left an indelible mark in history in the middle of the 19-th century. During certain periods famine hit Russia. But those were clearly local outbreaks of famine often caused by inaction or insufficient efficiency of the authorities.

If we are to define the causes of the British Industrial Revolution in simplified terms, the main cause then was the fact that the people had resolved the many age old problem of food supplies and got on with other problems.

Two tendencies which have been continuing to this day go to show that the food problem was indeed resolved: multi-fold growth of the Earth's population and growing percentage of the Earth's urban population.

Theories of the impact exercised by the agrarian revolution in Britain on the Industrial Revolution have been put forward on many occasions. The Russian language section of Wikipedia devoted to the British Industrial Revolution says that it was made possible due to the agrarian revolution which took place before the British Industrial Revolution.
Jack Goldstone (2013) mentions that, in the opinion of one of scholars polled by him, the cause of the British Industrial Revolution was the fact that «progress in agriculture had made workforce redundant and available for industry». But, it is my opinion that this point of view needs to be paraphrased as follows: ***«progress in agriculture <u>in Europe</u> made <u>British</u> workforce redundant and available for the industry»***. Without other countries, which were given the opportunity of supplying food to Britain, industrial growth in Britain would have been there but would not have been so «explosive», revolutionary.
Massimo Livi Bacci (2010) in his «La Popolazione nella storia d'Europa» writes: «Growth of urbanization is a reliable indicator of the settlement system stability. The appearance of an urban structure has something to do with existence of densely populated rural area which produces surplus product sufficient for barter with the city and which allows the latter to transition to production and professional specialization». One can and needs to paraphrase the above to make it apply to the British Industrial Revolution: ***Britain's emergence as the first industrial country is a reliable indicator of the fact that around it there were densely populated agrarian countries producing food in the quantity sufficient for barter with Britain and allowing the latter to transition to specialization in producing industrial goods.***

Indeed, we have already seen above the data showing that, in Britain, agriculture productivity was growing and the area of arable lands was expanding. But that was not a purely British phenomenon. Agricultural productivity growth was taking place in other countries, too. The area of arable lands was expanding, among other countries, in Russia and the U.S.A., too. This growth of productivity enabled «the city» to take away more and more surpluses from «the countryside» in order to pay for imported industrial goods which were expensive at that time. In other words, «supply» of food was becoming available in the European market and, if the U.S. market is to be considered, it was becoming available in the global market. But this supply which was being generated was, to a great extent, only potential one; it did not find any «demand», i.e. there was no sufficient quantity of industrial goods which could be obtained in exchange. It so happened that the European market could have demand for industrial goods but did not find any adequate supply before the industrial revolution. And Britain was the first to respond to this!

Even in those European countries where food surpluses were not either great or were lacking entirely, food was taken away by the «city» from the «countryside» and could be exchanged for imported industrial goods. «We'd rather not eat enough than not export!» was the statement ascribed to I.A.Vyshnegradsky which conveys well the spirit of this phenomenon.

Global Influence of the British Industrial Revolution.

The influence of the Industrial revolution on other countries was versatile. On the one hand, it stimulated labor productivity in the agriculture of other countries. On the other hand, Britain's domination in the industrial goods markets later «suppressed» the development of industry in other countries.

The consequences of the British Industrial Revolution were truly global. It exercised influence on the rest of the world. Britain, by virtue of being the first, acquired a huge advantage. We have already mentioned a specific example referred to by Clark of how inhabitants of Tahiti, when they met the English for the first time, were ready to give away a twenty pound pig for a common three inch nail. But having found itself to be the first industrial country in Europe, Britain, to a certain extent, made «aborigines» out of all the remaining European countries .

For some period of time, a good «smoke screen», covering up the true reasons behind Britain's success was the theory of comparative advantage devised by Richardo which firmed up this status quo beneficial to the English. The core idea of the theory is simple enough: since we, Brits, are not so bad at making nails (fabrics, dishes, etc.), and you do well at growing pigs (wheat, cotton, wine etc.), it is best not to change anything, let everyone specialize in making what they make best. Given Britain's obvious success in the economic sphere, people who shaped the economic policy in certain countries, could well follow such recipes suggested by the Brits without suspecting a pitfall. The more so because at the initial stage agrarian countries started to prosper more and more.

British Revolution as Driver of Growth for Agriculture of Other Countries.

Britain turned out to the first to respond to the «dormant» demand on the part of the agrarian countries in Europe for industrial goods! Demand was indeed «dormant», «emerging» one. What did it manifest itself in? In the fact that growth potential of agricultural production was there, but it did not make sense to ramp up production as external demand for food was low (as other countries were agricultural and, on the main, they provided for themselves). At the same time, industrial products were perceived to be of high value (let us recall that the English, thanks to trade, were good at marketing).

Robert Allen writes: «In 1842, Francis Swansi, the English governor of the Gold Coast, speaking in the Parliamentary committee, said that foreign trade using new goods helps intensify African labor as it opens up an opportunity for them to purchase consumer goods: «People's needs grow every day. Stop by the aborigines' homes and you will find European furniture in them; in the yard you will see European agricultural implements; they wear more clothes; as a matter of fact, their situation has significantly improved, their needs are growing, but they cannot be satisfied by basking in the sun; they have to work». One can make allowance for Swansi to have rationalized Britain's colonial policy in such a way but there is definitely a fair amount of truth in these words.

A similar thing repeated itself a hundred odd years later: «City's industrial enterprises do not produce enough goods for barter for foodstuffs produced by the farmer. … A farmer cannot

find on sale the goods he needs. As a result, sale of the agricultural product produced by him for money which he cannot use appears to be an unattractive deal for him. Therefore, large plots of land which he used previously for sowing are now being used for pastures. He uses more grain to feed cattle on and has at his disposal a sufficient volume of foodstuffs for himself and his family; at the same time, he may be short of clothes and other simple fruits of the civilization». This is a quotation from relatively recent history. These words were said, in 1947, by George Catlett Marshall, US Secretary of State, to describe the situation in post-war Germany and to explain the need for aid to be provided to Europe in its recovery after World War II (the so-called «Marshall Plan»). These words also resound with the farmers' «dormant» potential to produce more food in exchange for industrial goods…

In other words, Britain had not only found itself to be «at the right time and at the right place», by responding to incipient demand. It also stimulated further intensification of agricultural production in Russia, Poland, Prussia, etc. as in exchange for grain surpluses and surpluses of other foodstuffs it was now possible to obtain industrial goods from Britain.

Suppressing the Industry of Other Countries.

Britain beat other countries to it in acquiring more productive methods of manufacturing fabrics and other industrial goods, which were perceived to be of high value in other countries. Therefore, Britain managed to gain a great deal through barter with other countries. Since it became possible to replace food of its own production with imported food, there offered itself an opportunity of moving an ever increasing number of people from less productive agricultural sector to the industrial sector. Let us consider this mechanism using a simple numerical example taken from the article «Time Is Money. Theory of Value Depreciation» (Blinov, 2013).

Suppose there are two countries: ***Country A*** and ***Country B***, where 5 million people in each country are engaged in productive labor (the balance being children, family members, etc.).

At the first stage, in both countries the food produced is just enough to keep the population fed and there is no surplus, with all the people being busy all their working time.

At the second stage, there occurs a leap in productivity. In each of the two countries, the work done by four million people is already enough to provide enough food for the country. One million people capable of work are made redundant in each country and can now produce additional goods. According to the theory of value depreciation, these goods will be valued higher. But as between the countries there is a possibility of exchange, two extreme scenarios for role distribution are possible between them (the remaining multiple scenarios are intermediate ones).

Scenario 1: the countries begin producing the goods of the next level on their own, independent of each other, without using the opportunity of exchange. This scenario presupposes parity in the economy of the two countries (with everything else being equal). We will not be considering that.

Scenario 2: one country (suppose, ***Country A***) begins specializing in production of new goods. Let us consider this scenario. To facilitate understanding, let us assume that ***Country A*** begins specializing in the manufacture of fabrics (new good), while ***Country B*** continues specializing in production of food and all the surplus food is exchanged for fabrics as part of the process of trade with ***Country A***. The key factor in the exchange will be the working time spent on production of the goods taking part in the exchange.

Let fabrics in the quantity of *X* be equivalent in the exchange to food in the quantity of *Y* (units of measurement in this case do not matter to us). In the meantime, production of fabrics in the quantity of *X* in country *A* takes 10 hours of working time. At the same time, production of food in the quantity of *Y* in country *B* takes 20 hours of working time. This ratio (productivity in country *A* is twice that in country *B*, if they are reduced to the equivalent), in particular, will play a decisive role in the well-being of the countries after the exchange.

During the process of exchange, the food (the product of work done by 1 mln. people in country *B*) will be exchanged for fabrics (the product of the work done by 0.5 mln. people in country *A*).

After the exchange, there will be the following distribution of goods between the two countries:

Country *A*:

- Food (product of the work done by 4 mln. people) – the country's own production.
- Fabrics (product of the work done by 0.5 mln. people) – the country's own production
- Food (product of the work done by 1 mln. people) – obtained as a result of exchange with country *B*.

Note: fabrics (product of the work done by 0.5 mln. people) transferred to country *B* as a result of exchange.

Country *B*:

- Food (product of the work done by 4 mln. people) – the country's own production
- Fabrics (product of the work done by 0.5 mln. people) – obtained as a result of exchange with country *A*.

Note: food (product of the work done by 1 mln. people) was transferred to country A as a result of exchange.

In this example, where two countries are considered, any further exchange is impossible as country B has fully used up the free resources (food – the product of the work done by 1 mln. people) for exchange.

It is clear that ***country A, as a result, is the winner: it has additional food – the product of work done by 1 mln. people***. It can use this food only one way: by making redundant 1 mln. people (out of four million engaged in Country A in producing food) to produce additional goods.

Suppose there are other countries like country *B* which have surplus food (or can produce surplus food). Then country *A* can relocate one million people made redundant to the same production of fabrics for exchange with these countries. More highly productive labor will be replacing less productive labor and the country will be gradually producing less food and will be more and more specialized in producing industrial goods.

If you now imagine that country *A* in our hypothetical example is England, you will see several key coincidences with the actual picture of the Industrial Revolution.

1. Britain continuously increased the percentage of import in the food consumed. Britain's own production of grain was invariably falling down, especially as a result of cheap imports. At the end of the day, grain production started to account for a meager portion. What remained in terms of food production was mainly only meat and milk cattle breeding, growing fresh vegetables since here competition against imports was still possible due to fresh food supplies.
2. There were countries which were ready to supply it to Britain (Russia, U.S.A., Germany, Poland and others). Competition in the grain market developed to such an extent that at

the end of the 18-th century there happened the so-called «grain» crisis, when the prices for grain fell sharply, primarily due to deliveries of cheap grain from the USA.

Clark cites the following data (2013, p.442): «In 1913, the percentage of the population engaged in agriculture in the U.K. was 8% . In Romania this number was 80%, whereas in Bulgaria it was 82%» Productivity was rising in the British industry, first of all, in textile and cotton manufacturing industry. "Whereas, in the 1760-s, in order to turn one pound of cotton into fabrics, it took 18 man-hours, by the 1860-s, the same had started to take only 1.5 man-hours (ib., p.329).

Talk about a unique coincidence! The idea is not to trade islands for beads or a pig for a nail as in trade with aborigines. ***The idea is to make aborigines out of the rest of Europe***! And this exactly what Britain succeeded in doing for almost half a century! Succeeded in being the "city" for the rest of Europe which was acting the role of the "countryside".

The whole thing did not limit itself to Europe only. Britain, as the "empire over which the sun never sets" exploited its advantage in trade with its colonies and other countries, too, such as China which after the "opium wars" became a "semi-colony".

We can read what Clark is saying regarding this matter: per capital industrial production volume in India and China had been shrinking all the time up until 1913 as these countries switched over to export of raw materials (in the case of India, it was wheat, jute, indigo and opium) in order to pay for importation of industrial goods from Britain". In the table which Clark provides (p.443 with reference to 1915 data of the US Department of Commerce), India's main export item (primarily to Britain as the metropolitan country) is "grain, beans and flour" in the amount of 196 mln. dollars. While the main import is "cotton fabrics and clothes" (mainly British made) and also worth 196 mln. dollars.

Followers

Suppose, this is Britain's success story and it is all fine. But what about other countries? Did they not understand what was happening? Yes, they did. Long before the Industrial Revolution, the European countries acting the role of «aborigines» were often cognizant of their role. Reinert (2011) in his book «How Rich Countries Got Rich and Why Poor Countries Stay Poor» quotes as follows:

«In 1558, the Spanish Finance Minister Luis Ortiz gave the following description of the current situation in his memorandum addressed to King Philip the Second: «From the raw materials of Spain and West India, specifically, silk, iron and conchilla (red paint), which they buy for one florin only, foreigners produce finished goods which they then sell back to Spain at a price from ten up to one hundred florins. Therefore, Spain is subjected on the part of the rest of Europe to still greater humiliation than the humiliation to which we, ourselves, subject Indians. In exchange for gold and silver, Spaniards offer Indians trinkets of greater or lesser value; but buying back our own raw materials from foreigners at an exorbitant price makes Spaniards the laughing stock of the whole of Europe»

It is exactly this kind of «humiliating» position that subsequently caused active steps on the part of other countries (first of all, the USA and Germany) aimed at developing their own industry. Purposeful industrial policy allowed these countries to break the vicious circle. Among the architects of the industrial policy, we can single out Alexander Hamilton and Friedrich List. They succeeded in creating the philosophical foundation which enabled Germany and the USA to break out of «Ricardo's» trap. But this is quite a different story.

Why Not China?

This is just the right time to address the question of why the Industrial Revolution did not happen in China? From my perspective, the key reason for that was that China never did resolve its food problem. Growth of food production could not keep up with the population growth. And ***the problem was not resolved at the expense of imports***. When the Europeans started to get active in trading with China, the inflow of silver into the country did not culminate in China becoming well provided with food. It is just that silver depreciated. As Dr. Nefedov (2007) stresses, when talking about the end of the 18-th – beginning of the 19-th centuries, in China «the English had to pay for Chinese goods in silver; that caused silver to cheapen in China, resulting in the «price revolution», similar to the one which accompanied the coming of European merchants to India». ***Had China had external suppliers of food*** and had it been able as well as to purchase food from other countries for the money earned by selling fabrics, tea and other goods, quite a different situation would have unfolded.

I do not know what played the key role in the lack (or too small amounts) of food imports into China. It could have been that there were no food surpluses in the neighboring countries; China's isolationist policy may have had its hand in it; it may have been that the country's very size was critical to it: it is one thing when large Europe provided food to much smaller Britain, and quite another thing when one had to provide food to such a huge country as China.

In any case, due to lack of opportunities for food imports, China was unable to effect the transition similar to that accomplished by the English.

Conclusion.

Let us now try to recapitulate. Britain, just like Venice, Genoa, Holland, before it, had had experience in partially solving its food problem through food imports by supplying, in exchange, colonial goods and products manufactured by its own industry. Unlike these countries, Britain was better protected due to its insular position and gradual capture of advantage at sea. But it was only the overall improvement in food availability in the European countries (at the expense of growing productivity and expanded sown area) that enabled Britain to specialize in industrial production, while gradually abandoning its own production and thus gaining a ever greater benefit in the trade with other countries.

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