

# Sustained growth and the increase in work hours

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Dietrich Vollrath, June 11, 2018

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Back in March, I [posted](#) a summary of some [research](#) by Jane Humphries and Jacob Weisdorf on the onset of economic growth. Their paper documented *annual* labor contract terms in England over several centuries, and compared those to the typical *day* labor rates that have been used in economic history to study the onset of growth and the effects of the Industrial Revolution. The short version of that paper is that the annual labor contracts starting seeing sustained growth in their value around 1650 or so, far sooner than the day wages indicated. This pushes back the origin of economic growth to well before the actual technological IR, and this also matches the data on GDP per capita developed by Broadberry, Campbell, Klein, Overton, and van Leeuwen in [British Economic Growth, 1270-1870](#).

One thing that I didn't address in my post, but which came up in a few replies I saw, was whether the data on annual contracts (and on GDP per capita) indicate a rise in *living standards*. Let's take the day wage data as factually correct, and those day wages remained roughly constant from 1650-ish to 1850-ish. This has several implications. First, people that did work for day wages in this period would only see their annual income rise by working more days or hours per day. Second, if the value of annual contracts were tied in some way to the day wage, then annual contracts rose in value also due to rising work effort in days/hours. For both types of workers this doesn't seem to indicate that they are better off, just working more hours.

And what little evidence we do have on actual hours worked does seem to indicate that they increased a *lot* in the period around the actual Industrial Revolution. Hans-Joachim Voth, in two papers from [1998](#) and [2001](#), as well as a book [Time and Work During the Industrial Revolution](#), provided estimates of work hours based on court records. Around 1760, annual hours were about 2500, while in 1800 and 1830 annual hours were about 3300, before dropping back to about 2700 in 1870. In the period of the actual (technological) Industrial Revolution, it would appear that work hours did rise substantially. We know the day wages did not rise until around 1850-ish. But with the rise in hours worked, the annual income of a worker would have risen during the early 1800's. We might assume that those workers on annual contracts, if they were part of the same labor market, would also have seen their hours rise, and hence their annual income growth was due to more work time as well.

This doesn't settle anything, however. The HW data indicate that the value of annual contracts began to grow in the middle of the 1600's, well before the rise in hours documented by Voth. If annual hours were consistent at 2500 from 1650 to 1750, then that means the rise in annual contracts represented growth in the implicit income per hour for those workers as well. On the other hand, you could argue that even the growth that HW document was driven by hours. In the 100 years from 1650 to 1750, HW estimate annual

contracts grew in value by 67%-ish. If that was driven entirely by an increase in hours worked, then hours worked had to grow by about 67% as well. That would mean that in 1650 annual hours worked on these contracts were around 1,500. Is that reasonable? I don't know that there is an obvious answer to that question. There is plenty of evidence for long idle periods in agricultural work, and so 1,500 hours in a year might have been the normal amount expected in 1650. On the other hand, that seems like a *huge* increase in hours worked.

But let's assume that even the rise in annual contract value was driven entirely by an increase in hours worked. And let's stretch this argument out so that while annual contracts (as well as GDP per capita) started growing in 1650, it wasn't until 1850 that this was because day/hour rates rose. Does this mean that the growth in annual contracts and GDP per capita did not represent a rise in *living standards* until 1850?

The answer to that depends on the reason for the rise in work hours. If they were physically coerced, then for sure you'd say that the growth in per worker annual contracts or GDP didn't represent a rise in living standards. But on the assumption that the extra hours were not coerced, then we need to think hard about the labor supply decision of workers. Mark Koyama has a nice [paper](#) that lays out a simple theoretical model for thinking about this, and the particular feature of this model that matters is the possibility of a backward-bending labor supply curve. When wages are very low, people provide very little labor to the market. Why bother? But as wages rise, people provide more labor to the market, because it is worth their time to work, as the wage they earn allows them to consume more goods. But on the assumption that people do enjoy non-work time, at some point the wage gets high enough that people start providing *less* labor. If you can earn enough to buy everything you want in 30 hours a week, why work 40 hours? This is the backward bending part of the labor supply curve.

What Mark does is then work through various ways in which work hours might rise, the implication for living standards, and how these relate to different stories about economic growth. We can see which might make sense in the English case.

## Immiserating growth or involution

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The first case is one where the wage starts (say in 1650) high enough that we are "on" the backward bending part of the labor supply curve. At this point, a negative productivity shock (e.g. a bad harvest) pushes down the wage, and because we are on the backward bending part of the supply curve, this *raises* the amount of labor done. More hours at a lower wage would imply workers are worse off. Yet, if the elasticity of labor supply with respect to wage is *large* enough, then the overall effect on earnings is *positive*. A large shift in L, even with a decline in  $w$ , can mean that  $wL$  (total earnings) increase. We could thus interpret the onset of annual contract growth in the HW data as an example of immiserating growth.

One issue with this story is that while we do not see growth in daily wages in the data, we also do not see a substantial *decline* in wages. Yes, wages appear to decline from about 1450 to 1650, after the Black Death when population is rising, but after 1650 the wage data

shows, if anything, a very small positive trend. Without clear evidence of a drop in the wage, and with the need for what seems like an unreasonably large labor supply elasticity, this story doesn't seem to fit.

## Involution

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There is a second theoretical case that can be used to generate more hours without rising living standards. This could occur because of an increase in the price of a necessity or subsistence good, like food. Because people have to consume a certain amount of this necessity, if it gets more expensive, they have to either work more hours, or decrease their consumption of all other goods. Under the assumption that people enjoy both leisure and consuming other things, they'll decrease both by a little. The drop in leisure means an increase in work time, and hence we've got a rise in hours.

This doesn't require us to assume that workers are already on backward-bending part of the labor supply curve. The rise of the price of the necessity shifts down the whole labor supply curve down, and so people work more hours regardless of where they were to begin with.

Whether this results in an increase in measured earnings ( $wL$ ) depends on the effect of the rise in the price of the necessity on the equilibrium wage, and how much the labor supply curve shifts. You can wrestle the model into giving you an increase in  $wL$ , while people are still worse off. This kind of effect has been called "involution" before, a concept that at some point in my life I'll write a much longer post about. But for the present post, the problem is that there is no obvious rise in food prices in England starting in 1650.

## Industrious revolution

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This leaves us with the last case that delivers an increase in work hours and living standards, which captures the intuition of Jan de Vries "Industrious Revolution", which you can read about [here](#), in one of the more enjoyable books on economic history you'll come across.

The story here is that there are different kinds of consumption. Some consumption is time-intense (e.g. Netflix) in that it requires a little of your money, but a lot of your time to consume it. Some consumption is good-intense (e.g. clothes) which requires a lot of your money, but very little of your time. And no, don't get too picky on that distinction. Yes, you might wear a shirt for 12 hours, but once it is on you don't have to spend any time or attention to keep wearing it.

If time-intense consumption is cheap, then you'll tend to buy lots of it, and that means you'll work very little. You don't need much money to buy these consumption items (so you don't need to work much), and you do need time to enjoy them. The argument here would be that England prior to 1650 was a world in which time-intense consumption was cheap. Workers had little need to work more hours, because why bother? What were you going to purchase with that extra income? It made sense to buy the time-intense consumption good, leisure.

But around the middle of the 17th century, in line with de Vries' argument, new good-intense consumption goods became available, like sugar and tea. So people shifted their consumption towards these things, which did not require much time to enjoy, but did require you to purchase something. So putting more labor into the market made sense. Similarly, the price of textiles was falling at this time (yes, prior to the IR). People shifted from the time-intense activity of making ones own clothes, towards the good-intense purchase of ready-made clothing.

The decline in the price of these good-intense consumption items "straightens out" the labor supply curve, making the transition to backward-bending occur at a higher level. And hence for any given wage, the labor supplied is higher. In this setting, living standards are *rising* with the increase in work time, as this is an optimal response to a drop in the price of one of the available consumption items. The drop in the price of good-intense items shifted time spent at home (and out of the labor market) into time spent in the labor market. Unlike the prior two explanations, the data work here. The prices of things like tea and sugar and clothing did fall in the period starting from the mid-1600's, at the same time hours were rising.

## So is it all about trade?

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Okay, let's say that we buy the story of the industrious revolution, and buy that the onset of growth in annual labor contracts and GDP per capita starting in 1650 represented a real gain in living standards. One interesting implication of this is that the origin of sustained growth was associated, in large part, with the expansion of trade in England. Rather than a series of clear technological breakthroughs (e.g. the spinning jenny, etc.) it was the "technology" of trade, by inducing a change in the available basket of consumption goods, that kick-started sustained growth.

What is a fascinating question is how important trade was in *sustaining* sustained growth. That is, the availability of cheap trade goods could have created a period of rapid growth in the late 17th century, perhaps running through the late 18th century. But without the continued expansion of trade to bring in new goods, or finding cheaper sources of those goods, could growth have continued? Even if you could find new and cheaper imports, at some point wouldn't people reach a limit on how much additional time they wanted to work?

Hence you could argue that the technological Industrial Revolution of the late 1700's and early 1800's was necessary to keep sustained growth going after trade got things started, and that technological innovation is still necessary for growth to continue indefinitely. But you could also argue that without trade creating growth to begin with, there never would have been an incentive to make those technological changes in the first place. I'm well beyond my brainpower capacity to answer this. But the HW data, along with the Broadberry et al data on GDP per capita, by pushing back the date of sustained growth to 1650, makes the link between trade and the Industrial Revolution more salient. Did the Industrious Revolution trigger the Industrial Revolution?

Regardless of the answer to that, I think it is a good working hypothesis that the growth documented by HW and Broadberry et al starting in the 1650's was associated with real gains in living standards, as the increase in hours worked is consistent with a switch to

goods-intense consumption items.

## A complete aside

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This has absolutely nothing to do with the onset of sustained growth. But the logic of the industrious revolution I presented above can be used in reverse to think about changes in economic growth in the recent past. You could argue that recent innovations have made time-intense consumption items (e.g. Netflix or video games) cheaper. And in a mirror image response to the 1600's, people are substituting more time-intense consumption for goods-intense consumption. This means that they willingly withdraw labor from the market in order to enjoy those time-intense activities, as in the proverbial 20-something male living in his parents basement playing Halo all day. Nothing terribly insightful here, I just thought I was interesting to think about this as the flip of the industrious revolution.

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