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Onwards and upwards: American productivity growth during the Great Depression

Gerben Bakker, Nicholas Crafts, Pieter Woltjer

The Great Depression is considered one of the darkest times for the US economy, but some argue that the US economy experienced strong productivity growth over the period. This column reassesses this performance using improved measures of total factor productivity that allow for comparisons of productivity growth in the Depression era and in later decades. Contrary to Alvin Hansen's gloomy prognosis of secular stagnation, the US economy was in a very strong position during the 1930s by today's standards.

Alexander Field (2003) described the 1930s as the "most technologically progressive decade" of the 20th century for the US. He argued that total factor productivity (TFP) growth peaked at that time and was spread widely across the US economy. In making these observations, Field relied primarily on the classic study by Kendrick (1961), but took the 1930s to comprise the years 1929 to 1941, to cover fully both downturn and recovery.

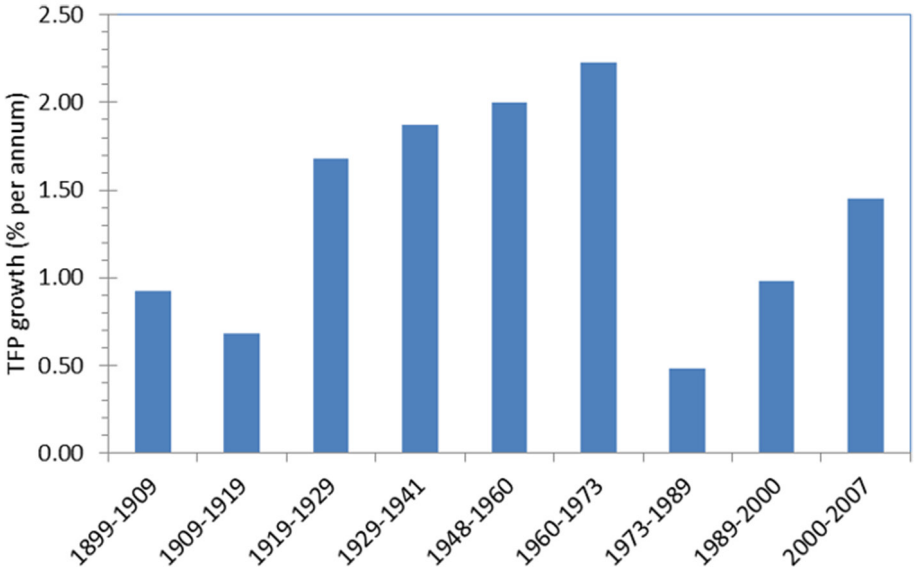
Field's conclusions may strike today's economists as surprising. Everyone knows that the US experienced a massive banking crisis during the 1930s and most also remember that Alvin Hansen (1939) famously diagnosed 'secular stagnation' as the prognosis for the US economy largely on the basis of pessimism about technological progress. Recently, and in a similar vein, Robert Gordon (2016) has claimed that WWII saved the US from secular stagnation and that in the absence of the war, US growth prospects would have been dismal at best.

Our new paper revisits the measurement of TFP growth in the US before WWII (Bakker *et al* 2015). We have constructed estimates which improve on those of Kendrick in several important ways. In particular, we provide a much more detailed breakdown of TFP growth at the industry level and we take account of improvements in labour quality and capital services. This type of thorough growth accounting controls for heterogeneity across the factor inputs. Consider labour input. Simple hours-worked data combine hours of lawyers, managers, barbers, bricklayers as well as farm labourers, disregarding the differences in education, work-experience, and gender across these workers. As noted by Fernald (2014), these various professions have very different wage rates, which is likely to correspond to differences in marginal products. In a similar vein, a light truck (that is generally written off in about 10 years) needs to have a higher marginal product than a hospital (which might provide services for 50 years). In our paper, we weight the different factor inputs using observed or estimated relative factor prices to control for these implicit differences in marginal products. For 1929 to 1941, this yields a new set of estimates constructed on a similar basis to that used by the US Bureau of Labor Statistics nowadays, allowing us to compare the growth of TFP during the Depression to technological change in later decades.

An overview of these new estimates of the sources of labour productivity growth is given in Table 1. Compared with Kendrick, we find that labour quality contributes more and TFP growth less. For this period as a whole, TFP growth

accounted for about 60% of labour productivity growth rather than the 7/8th famously attributed to the residual by Solow (1957).[1] Contrary to secular stagnation pessimism, TFP growth was very strong both in the 1920s and the 1930s, at 1.7% and 1.9% per year, respectively – well ahead of anything seen in the last 40 years. Regardless, even though the 1930s saw the fastest TFP growth in the private domestic economy before WWII, it was not the most progressive decade of the whole 20th century in terms of TFP growth. Both 1948-60 and 1960-73 were superior at 2.0% and 2.2% per year, respectively (see Figure 1).

Figure 1. TFP growth in the private domestic economy, US, 1899-2007 (% per year)



Note: the post-war break points are chosen on the basis of NBER business cycle peaks.

Sources: Bakker *et al* (2015) and Bureau of Labor Statistics, "Historical multifactor productivity measures", http://www.bls.gov/mfp/home.htm (October 2014); National Bureau of Economic Research, "US business cycle expansions and contractions," http://www.nber.org/cycles.html (accessed 28 November 2015).

Table 1. Sources of labour productivity growth: US, 1929-1941 (% per year)

	1899-1909	1909-1919	1919-1929	1929-1941	1899-1941
Capital Deepening	0.2	0.4	0.3	0.1	0.2
Labour Quality	0.6	0.7	0.4	0.5	0.5
TFP	0.9	0.7	1.7	1.9	1.3
Total	1.7	1.8	2.4	2.4	2.1

Notes: growth accounting estimates for the private domestic economy. For 1929-1941, growth accounting is based on estimates of capital and labour services constructed on a similar basis to those provided by the BLS for the post WWII period. For 1899-1929, estimates are on the basis of the capital-stocks concept used by Kendrick (1961) but labour quality is on a labour-services basis which, unlike Kendrick, takes into account improvements in education within occupations.

Source: Bakker *et al* (2015).

That said, as Table 2 reports, Field's emphasis on the very broad-based advance in TFP during the 1930s is amply justified. Strong TFP growth is consistent with the recovery of R&D spending after the early 1930s, with the volume and range of technical publications in the late 1930s (Alexopoulos and Cohen 2011), as well as with the influx of foreign technology and knowledge in the interwar period, which led to a 20-30% spillover-induced increase in domestic invention in affected scientific areas (Moser and Voena 2012, Moser *et al* 2014). Nicholas (2003) found that a fifth of patents assigned to quoted industrial firms in the 1920s were still cited in patents granted in the last quarter of the 20th century.

Table 2. TFP growth and TFP contribution to labour productivity growth, US private domestic economy, 1919-1941 (% per year)

	1919-29		*1929-41*	
	TFP Growth (% p. a.)	*Contribution (%point p.a.)*	*TFP Growth (% p. a.)*	*Contribution (%point p.a.)*
Private Domestic Economy	1.7	1.68	1.9	1.87
Manufacturing	4.5	1.18	2.3	0.61
Non-Manufacturing	0.6	0.50	1.8	1.26
'One Big Wave' Sectors	2.6	0.60	3.1	0.74
Chemicals	7.6	0.21	0.7	0.02
Chemicals	7.1	0.08	2.1	0.03
Petroleum, Coal Products	8.2	0.10	-1.1	-0.01
Rubber Products	7.3	0.03	1.5	0.01
Electricity	2.6	0.07	4.9	0.15
Electric Machinery	3.1	0.03	4.6	0.05
Electric Utilities	2.3	0.04	5.1	0.10
Internal Combustion Engine	1.9	0.30	3.3	0.54
Transport Equipment	7.9	0.14	3.5	0.07
Local transit	3.6	0.04	0.4	0.00
Distribution	0.9	0.12	3.4	0.46
Communications	2.0	0.02	2.5	0.04
Telephone	1.1	0.01	1.4	0.01
Spectator Entertainment	3.2	0.02	4.4	0.02

Note: Contribution = value-added share * TFP growth. 'Chemicals',' Electricity', 'Internal combustion engine', and 'Communications' are the 'One big wave clusters' listed in footnote 2.

Source: Bakker *et al* (2015).

The key 'one big wave' technology clusters[2] of the second industrial revolution highlighted by Gordon show up strongly, but certainly do not dominate. Manufacturing contributes well below half of all TFP growth and the largest sectoral contribution comes from distribution. This was not an economy whose TFP growth was dominated by one general purpose technology, even one as important as electricity – unlike the late 20th century, where ICT loomed much larger. R&D was much more sectorally concentrated than TFP growth, which suggests that the benefits of technical progress spread widely rather than being confined to sectors in which they originated.[3] The ability of large 'unexciting' sectors such as agriculture, distribution, or financial services to use new technology effectively seemed far more important, as they had a greater impact on growth than the small 'exciting' high-tech sectors.

It still seems reasonable to believe that rapid TFP growth in the 1930s was in spite of – rather than because of – the Great Depression. Bank failures and the disruption of lending that resulted were an adverse shock which hurt innovation although the localised nature of bank distress mitigated the impact on R&D somewhat (Nanda and Nicholas 2014). The resilience of TFP growth in the 1930s reflected US success in creating a strong 'national innovation system' based on world-leading investments in human capital and R&D (Goldin and Katz 2008, Mowery and Rosenberg 2000) and a market economy in which creative destruction could flourish, which had become well established by the first quarter of the 20th century.

This is reflected in impressive TFP growth in the 1920s and the much greater success of the US in exploiting the opportunities of the second industrial revolution compared with rivals like the UK. US TFP growth was about three times UK TFP growth in the interwar period, and was at least twice as fast in every major sector except agriculture and construction.[4] The strength of the US at the time lay in good horizontal (rather than selective) industrial policies which underpinned private-sector innovative effort while at this point federal government R&D was unimportant.

The US still had a significant unemployment problem in the late 1930s, but it surely would not have faced long-term secular stagnation in the absence of WWII. As Kevin O'Rourke (2015) has recently emphasised, based largely on rapid TFP growth, the 'natural rate of growth' was high in the US at this time and this would have underpinned high levels of investment to allow capital stock growth to keep up. WWII may have been helpful in offsetting hysteresis effects in the labour market (Mathy 2015), but it was not required to rescue the economy from low trend growth. By today's standards, the Depression-era US was in a very strong position even when Alvin Hansen was so gloomy.

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Footnotes

1 TFP growth and labour quality together account for 85% of labour productivity growth so the contribution of physical capital deepening is much the same as in Solow (1957).

2 These clusters were based on electricity, the internal combustion engine, chemicals, and information, communications and entertainment.

3 In fact, very few industries were research-intensive. Only chemicals, petroleum and electrical machinery had more than 1% of the labour force employed as scientists and engineers.

4 Based on a comparison of Bakker *et al* (2015) and Matthews *et al* (1982).

About CAGE

Established in January 2010, CAGE is a research centre in the Department of Economics at the University of Warwick. Funded by the Economic and Social Research Council (ESRC), CAGE is carrying out a five year programme of innovative research.

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Department of Economics, University of Warwick, Coventry CV4 7AL
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