Misallocation and Productivity during the Great Depression

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A major open question surrounding the Great Depression involves the dynamics of aggregate productivity. Ohanian (2001) notes that measured aggregate TFP falls by 18% relative to trend from 1929 to 1933. He suggests that possibly 1/3 of the fall can be explained by factors such as capacity utilization, factor input quality, labor composition, labor hoarding, and increasing returns to scale. This still leaves a massive decline in TFP remaining to be explained. On the other hand, Field (2011) has argued that the Depression was actually a "great leap forward" for the U.S. economy with a number of major innovations made and adopted widely such as the refrigerator, which starts from a penetration ratio of around 5% in 1930 and rises to nearly 40% by 1940 (Lebergott, 1976). This makes the decline in TFP all the more puzzling.

I offer a new hypothesis to explain this decline: misallocation of resources across production units contributed substantially to the decline in aggregate TFP. To develop this hypothesis, I build a novel firm-level dataset of manufactured ice plants from the Census of Manufactures taken in 1929, 1931, 1933 and 1935. Of course, ice is not representative of the overall manufacturing sector. In fact, its industry productivity dynamics do not exactly match the overall manufacturing sector. Productivity initially rises in the ice indsutry before plummeting in 1935. Still I work with this industry because of a number of nice features. First, the the product is very homogeneous making price and productivity comparisons valid.[1] In addition, the production process is extremely simple. In fact, because I observe a good measure of a firm's capital stock and output, I can estimate firm productivity directly without relying on a particular demand structure.

To conceptualize misallocation, I build on the "wedge" methodology used in both the growth (Hsieh and Klenow, 2009) (HK) and business cycle literatures (Chari et al., 2007), though in very different ways. Wedges are anything that distorts the actual outcome from the efficient one. HK

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[1]There is still differentiation along spatial dimensions as ice is a highly local product.

think of these wedges as an abstract tax on output or an input that varies by firm. The key distinction in the model of HK, which was pointed out by Foster et al. (2008), is the difference between physical productivity $TFPQ$ and revenue productivity $TFPR$, which by definition is equal to $TFPQ * p$, where p is the price a firm charges. Differences in $TFPR$ across firms can be used to back out "wedges" that distort outcomes. With those wedges in hand, the efficiency losses from misallocation can then be calculated.

This approach leads me to decompose changes in industry productivity into mean shifts in productivity as well as shifts in the second moment of these wedges. In addition, I examine how the correlation between the wedge faced by a firm and its productivity changes over this period of time.[2] I find that the mean productivity across firms falls much less than overall industry productivity. While shifts in the mean can explain 2/3 of the industry productivity shift from 1929 to 1931, it only explains 1/3 of the sharp observed decline from 1929 to 1935. This leaves the balance to be explained by the misallocation of resources. Both the dispersion of wedges and the correlation between wedges and productivity play a role here.

While industry and firm mean productivity look different in ice as compared to the rest of the manufacturing sector, the impact of misallocation appears to be common across a wider set of industries. In fact using data collected on the cement, refined sugar, and dried pasta industries, I find that for all these industries, industry productivity falls much more than the mean firm productivity in terms of labor productivity. This implies an important role for misallocation in understanding productivity dynamics in this broader sample as well. I exclude these other industries from the main analysis since they lack good capital measures.

I argue that these results highlight another role for the non-monetary effects of the banking crisis during the Depression (Bernanke, 1983). When credit markets collapse, resources can become stuck in areas where demand is relatively low or the firm employing them is unproductive. This misallocation leads to a loss in overall productivity. To develop this idea, I build a model of financial frictions along the lines of Gertler and Kiyotaki (2010) where banks face a cost of taking on more leverage. This feature generates an endogenous balance sheet effect that limits the amount a bank can lend based on its net worth. Firms are hit a reallocation shock that makes some firms more

[2] A very positive correlation has a major detrimental effect on industry productivity (Restuccia and Rogerson, 2008).

productive while others less so. This leads to a demand for banks to fund capital transfers from low productivity to high productivity firms. In the case when interbank markets are imperfect, these banking frictions lead to limitations on the reallocation of resources between productive and unproductive firms thereby generating dispersion in $TFPR$ and a loss of productivity. Besides generating dispersion in $TFPR$, the model also generates a positive correlation between $TFPR$ and $TFPQ$ as firms that are productive find themselves stuck having to borrow from banks that are financially constrained.

So in response to a shock that damages bank balance sheets, both dispersion in $TFPR$ and the correlation between the two increase as banks are unable to loan to firms that need credit. This leads to an endogenous decline in productivity and a dynamic multiplier effect as lower productivity slows the repair of bank balance sheets, which in turn lowers productivity tomorrow and so on. A calibration exercise shows that a decline in bank capital similar to that experienced during the Depression can have quantitative implications on TFP similar to the results I find.

In many ways, focusing on misallocation and reallocation at a business cycle frequency and in the context of the Great Depression seems quite natural. In Bob Hall's felicitous phrase this was a time when the US became a "temporarily underdeveloped country." However, not all the areas of the country became underdeveloped in the same way (Rosenbloom and Sundstrom, 1999). So there was massive scope for reallocation of resources across regions. More to my particular industry, ice is a very local product. Hence, when local demand is relatively high, ice cannot simply be imported instead firms must import capital from regions with low demand to expand production. In a slightly different context, Bernstein (1987) argued that the reason why the Depression went on for so long was that new innovative industries were not able to draw resources sufficiently quickly from other older, sclerotic industries. This suggests as well large losses in terms of efficiency from misallocation between industries (though I only focus on intra-industry misallocation for now).

In the end, even if my approach is "successful" meaning it explains the difference between the fall in mean productivity and industry productivity, there will still be work to do. The question then becomes whether the "classical" explanations of productivity such as labor hoarding and labor composition can explain the fall in the mean productivity. If so, these older ideas in in conjunction with my approach could finally solve one of the more vexing problems of the Depression. This paper has attempted to take one small step towards that ambitious goal.

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