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Recessions and total factor productivity: Evidence from sectoral data

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ABSTRACT

The recent COVID-19 crisis has generated a concern that productivity (which was already at historically low levels) may further decline. From a theoretical standpoint, the recessions-total factor productivity (TFP) nexus is ambiguous a priori. This paper empirically examines the dynamic impact of recessions on TFP. We compute a new measure of utilization-adjusted productivity from a sample of 24 industries in 18 advanced economies between 1970 and 2014. Resorting to the local projection method we trace out the dynamic short to medium-term impact of such recessionary shocks. We find that deep recessions lead to a permanent deterioration in the level of total factor productivity. This effect is driven by the increase in resource misallocation across different sectors.

1. Introduction

In many advanced economies, productivity growth has been declining since the late 1990s and is now at historically low levels (Adler et al., 2017). Several factors have contributed to this decline, including: (i) the fading away of the growth effects of information and communication technologies (ICT) in the US in the end of the 1990s and at the beginning of the 2000s (Fernald, 2014a,b, 2016; Cette et al., 2016); (ii) the reallocation of resources to sectors where productivity growth was slower, such as construction (World Bank, 2018); (iii) and the effect of Global Financial Crisis (Tett, 2015).

The recent COVID-19 crisis has generated concern that productivity may further decline (Mauro and Syverson, 2020; Baldwin and Weder di Mauro, 2020). From a theoretical standpoint, the recessions-total factor productivity nexus is ambiguous a priori. On the one hand, in models of knowledge accumulation (e.g., Grossman and Helpman, 1991), a fall in the proportion of the labor force dedicated to research and development following a negative output shock could lead to a long-lasting negative impact on the level of productivity. On the other hand, in models of Schumpeter’s creative destruction (e.g., Caballero and Hammour, 1994),
recessions can have a cleansing economic effect by eliminating inefficient firms, consequently generating higher productivity and GDP growth. In particular, aggregate productivity can be affected by recessions in two separate manners: i) by means of their impact on productivity within each sector; ii) by inducing sectoral reallocations of input factors across different sectors. The effect through sectoral reallocation is not clear, since labor can move between various low- and high-productivity sectors, with an ambiguous net effect on productivity. Counter-cyclical reallocation takes place when input factor reallocation during a downturn leads to less productive jobs being destroyed and labor moving into more productive uses (Mortensen and Pissarides, 1994). Pro-cyclical reallocation occurs when more productive industries are disproportionately affected by recessions, for example due to credit constraints (Barlevy, 2003).

Therefore, the extent to which recessions impact total factor productivity (TFP) is ultimately an empirical question. Against this background, this paper offers new empirical evidence on the impact of recessionary periods on productivity, including through reallocation. While several studies have looked into this issue, we improve upon previous studies in two ways. First, we construct a new measure of TFP growth adjusted for time-varying unobserved use in capital and labor. Correcting for unobserved input factor utilization is crucial to accurately assess the development of aggregate TFP across the different phases of the business cycle and in the aftermath of recessions. Second, we explore the role of within- and between-sectors productivity.

Our analysis is carried out in three stages. First, we calculate time series of cyclically-adjusted TFP growth following the method used by Basu et al. (2006) and Fernald (2014a, 2014b), employing EKLEMS sectoral data for 18 economies from 1970 to 2014. Second, using the method proposed by McMillan and Rodrick’s (2014), we decompose aggregate TFP into two components: the within part—capturing the variation in TFP in each sector, while keeping unaltered the weight of each sector; and the between component—capturing the variation in TFP stemming from reallocation of resources across different sectors. Third, this paper employs Jordà’s (2005) local projection approach to estimate the dynamic response of TFP (and its components) to the recession shock. To shed light on the potential impact of the COVID-19 crisis, in the baseline, we focus on deep recessions identified by Blanchard et al. (2015). We then extend the analysis to consider alternative recessions and compare their productivity effects with those associated with deep recessions.

Our results suggest that deep recessions negatively and persistently impact productivity, with TFP declining by about 3 percent 5 years after the recession. These effects are the result of movements in both the within and between components of TFP growth. But while the within component of TFP declines markedly only in the short term, the effect of recessions on the between component of TFP increase it over time and contributes to the lion share of the medium-term decline in TFP. In other words, the persistent effect of recessions on TFP is mostly due to reallocation of activity from industries with relatively high TFP to industries with relatively low TFP. Similar results are found for deep financial recessions. In contrast, normal—that is, “non-deep” recessions—do not lead to a persistent fall in TFP.

The rest of the paper is organized in the following way. Section 2 discusses the empirical methodology and presents the data used to evaluate the impact of recessions on productivity. Section 3 shows and comments the main results. Section 4 provides concluding remarks and elaborates on the policy implications.

2. Data and methodology

2.1. Utilization adjusted total factor productivity

We follow the approach of Basu et al. (2006) and Fernald (2014a, 2014b) to estimate a measure of TFP growth adjusted for time-varying unobserved use in capital and labor, based on sectoral data. Correcting for unobserved input factor utilization is crucial to accurately assess the development of aggregate TFP growth across the different phases of the business cycle and, specifically, in the aftermath of recessions—the focus of the paper.

The approach consists in the following. Let’s start assuming that the production function of each industry i is given by:

\[ Y_{it} = F_i(A_{it}, K_{it}, L_{it}) \]

where \( A_{it} \) is TFP of industry i at time t; \( K \) and \( L \) denote the capital stock and labor inputs, respectively; the symbol \( \tilde{\cdot} \) denote utilization-adjusted capital and labor effort:

\[ \tilde{K}_{it} = K_{it} C_{ui} \]

and

\[ \tilde{L}_{it} = L_{it} E_{li} \]

where \( C_{ui} \) and \( E_{li} \) denote capacity utilization for capital stock and labor effort, respectively.

Following Basu et al. (2006), the production function (\( F_i \)) is assumed to be homogeneous of degree \( a_i \) in total inputs. Assuming a cost minimization objective, output growth is related to the growth of input factors for each industry i as follows:

\[ dy = a_i(dx_i + du_i) + dfpi \]

(1)

where \( dy \) refers to the growth rate of gross output and \( dfpi \) is TFP growth. \( dx \) is the observed input growth—defined as \( dx = s_k dK_i + s_l dL_i + s_m dm_i \); and \( du \) is the unobserved input utilization growth—defined as \( du = s_k dC_{ui} + s_l dE_{li} \).

The aggregate TFP growth is then obtained as the aggregate Solow residual minus the aggregate input utilization:

\[ dfpi = dfp_{solow} - du \]

(2)

This implies that TFP growth is equal to the Solow residual when there are no changes in utilization. The aggregate Solow residual and input utilization are calculated as weighted sums of industry Solow residuals and utilization measures, respectively:

3 Theoretically, the different set of constraints forced by recessions should close business of the least productivity firms and rise aggregate productivity (Petrovsky-Nadeau, 2013). Relatedly, we also have the “pit-stop” view of recessions in which these correspond to periods of reduced productivity and times during which restructuring can be done due to temporarily lower opportunity costs (Aghion and Saint-Paul, 1998). More recently, Gheorghe et al. (2020) assessed the cleansing effects of the Global Financial Crises looking at US regions.

4 Capital and labor reallocation toward more efficient sectors are shown to be a crucial determinant of productivity growth (Restuccia and Rogerson, 2017).

5 Studies looking at the impact of crises on TFP include Furceri and Mourougane (2012) and Oulton and Sebastia-Barriel (2013) that uncovered a long-lasting GDP impact, but not a long-lasting TFP effect of previous crises in advanced economies. Oulton and Sebastia-Barriel (2013) find that banking crises in 61 advanced and developing economies declined TFP by 0.8 percent. A small number of papers examined explicitly the pace of reallocation and its contribution to productivity growth over differentiated phases of the business cycle and most used U.S. manufacturing data. Davis and Haltiwanger (1999), Baily et al. (2001) and Barlevy (2003) found labor reallocation in the U.S. manufacturing sector to be elevated during recessionary periods compared to normal times or even boom periods. Davis et al. (2012) reached the same conclusion except for the immediate aftermath of the Global Financial Crisis. This cleanse was equally documented by Oostmhein and Pappadis (2015). In contrast, Foster et al. (2006) found weak evidence of counter-cyclical reallocation effects.
\[ dtfp_{s+1} = \sum_{i=1}^{I} w_i (dy_{i,t} - d_x) \]  

\[ du = \sum_{i=1}^{I} w_i (1 - sm_i) \gamma_{i,t} du_i \]

\[ \text{where } w_i \text{ is the industry proportion in gross output, and } sm_i \text{ is the proportion of input payments in total costs.} \]

The measure of cyclically-adjusted TFP is computed for an unbalanced sample of 18 advanced economies from 1970 to 2014, using EU KLEMS sectoral data for 24 industries. Table 1 shows some descriptive statistics of the measure of cyclically-adjusted TFP computed for the countries in our sample and it compares with those of the standard Solow residual. Fig. 1 plots, for each of the 18 countries in the sample, the time profile of both measures (additional summary statistics are provided in Table A1).

2.1.1. Decomposition into within and between components

Using the method proposed by McMillan and Rodrick’s (2014), we decompose aggregate TFP into two components: the within part; and the between part. Specifically, we decompose the cumulative changes in TFP between time \( t \) and time \( t + k \) as follows:

\[ tfp_{j,t+k} - tfp_{j,t-1} = \frac{1}{I} \sum_{i=1}^{I} w_{i,j,t} (tfp_{i,t+k} - tfp_{i,t-1}) + \frac{1}{I} \sum_{i=1}^{I} w_{i,j,t+k} (w_{i,j,t+k} - w_{i,j,t-1}) \]

where \( tfp_{i,t} \) is the logarithm of aggregate cyclically-adjusted TFP in country \( j \) at time \( t \), \( tfp_{i,t+k} \) is the logarithm of the cyclically-adjusted TFP of sector \( i \) in country \( j \), and \( w_{i,j,t} \) is the proportion of sector \( i \)'s value added.\(^6\)

The first right-hand side term corresponds to the within component while the second right-hand side term corresponds to the between component.

2.2. Methodology

The econometric method we use to assess the dynamic impact of economic downturns on productivity is Jordà’s (2005) local projection approach. The method allows us to trace the dynamics of productivity growth in the aftermath of recessions, controlling for pre-crisis trends in productivity. The following equation is estimated for each horizon \( k = 0, \ldots, 5 \):

\[ x_{t+k} - x_{t-1} = \alpha_0 + \gamma_1 + \sum_{i=1}^{I} \delta_{i} D_{i,t} + \sum_{i=1}^{I} \delta_{i} D_{i,t-1} + \sum_{i=1}^{I} \delta_{i} D_{i,t-1} + \epsilon_{t+k} \]

where \( x_{t+k} - x_{t-1} \) is the cumulative change of the dependent variable (cyclically-adjusted TFP and its within and between components) for country \( j \). \( \alpha_0 \) and \( \gamma_1 \) denote respectively country and time fixed effects. \( D \) is a dummy variable taking the value of one at the beginning of a recession period (see definition below), and zero otherwise. Additional controls include: (i) two lags of past output growth, (ii) two lags of recession dates, (iii) country-specific trends. Note that at some forecasting horizon \( k \), the dependent variable may already be affected by the recession, even though the variable measuring recession is set equal to zero. In such case, the effect of the recession on the dependent variable will be absorbed by the fixed effects rather than being reflected by the recession dummy resulting in a downward bias of the impact of recessions. To address this potential bias, we use the procedure of Teulings and Zanaboni (2014) and include forward values of the recession dummy between periods \( t \) and \( t + k-1 \) as control variables.

To shed lights on the potential impact of the COVID-19 crisis, in the baseline, we focus on deep recessions identified by Blanchard et al. (2015). They identify recessions using the approach suggested by Harding and Pagan (2002) and select deep recessions as those with a magnitude—based on cumulative GDP growth in the first eight quarters following the through—in the bottom 10 percent of the distribution of recession episodes. We construct a dummy that takes value of one in the first year of the recession and zero in all other years (Table A2). We then extend the analysis to consider alternative recessions and compare their productivity effects with those associated with deep recessions.

3. Empirical results

Before moving to the analysis on the effect of deep recessions on cyclically-adjusted TFP it is useful to examine the effects on aggregate output and input of production. To do so we estimate equation (6), alternatively using as dependent variables total output, employment and capital. The results presented in Fig. 2 show that deep recessions are associated with a significant decline in output of about 10 percent over the medium term—5 years after the recession. The effect on employment is similar to that of output, but slightly delayed. The stock of capital is found to decline by about 4 percent 5 years after a deep recession. Combining these effects on employment and capital with standard factor shares (about 2/3 for employment and 1/3 to capital) and comparing with the effect of output would imply a medium-term decline in TFP of about 2 percent.

In Fig. 3, we present the results obtained by directly estimating the

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\(6\) The list of countries in our sample is the following: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, the Netherlands, Portugal, Spain, the UK and the US.

\(7\) Labor reallocation from low- to high-productivity activities was a key determinant of productivity growth in several regions of the world. The impact of structural reallocation on aggregate productivity was studied by Carree (2003) for the advanced economies, Olley and Pakes (1996) and Timmer and Szirmai (2000) for the Asian region, Bartelsman et al. (2004) for a heterogeneous sample of countries, Saccoine and Valli (2009) for India and China, Van Biesebroeck (2005) for seven African economies, and Chansombophou and Ichihashi (2013) for the BRIC countries.

\(8\) These weights are those we also use to compute our aggregate measure of cyclically-adjusted TFP growth. Weights are given by \( w_i/(1-sm_i) \) in which \( w_i \) is the industry’s proportion in gross output, and \( sm_i \) is the proportion of input payments in total costs (Basu et al., 2006). The industry’s proportion in aggregate value added is used as weight in TFP growth rates.
effect of deep recessions on cyclically-adjusted TFP. They suggest that TFP declines sharply after recessions, by about 4 percent after 3 years, while remaining 3 percent lower than pre-recession levels 5 years after.

These effects are the result of movements in both the within and between components of TFP growth (Fig. 4). The within component of TFP declines markedly in the short-term—about 2 percent 2 years after the recession—but the effect dissipates over the medium term as the economy gradually recovers. In contrast, the effect of recessions on the between component of TFP is initially small and not statistically significant but increase it over time and contributes to the lion share of the medium-term decline in TFP. In other words, the persistent effect of recessions on TFP is mostly due to reallocation of activity from industries with relatively high TFP to industries with relatively low TFP.

Digging further, the results—not shown but available from the authors upon request—indicate that following past deep recessions economic activity has re-allocated from high productivity sectors such as information and communication, wholesale and retail trade and transportation to low-productivity sectors such as social services and real estate (results not shown but available upon request). These results are consistent with evidence provided in other papers suggesting that high productivity sectors tend to contract more during downturns (e.g. Aarson et al., 2004).

3.1. Sensitivity and robustness checks

3.1.1. Types of recessions

Results shown until now provided evidence that, on average, deep recessions have a significant and persistent negative effect on TFP. However, such losses are likely to vary with the severity and the type of recessions (real vs. financial crisis). To test for this possibility, we estimate equation (6) using two alternative recessions. In the first exercise, we construct a dummy that takes value 1 for all the other “non-severe” recessions identified in Blanchard et al. (2015). In the second analysis, we consider, severe recessions that coincided with financial crises—for this purpose, we rely on the financial crisis database constructed by Laeven and Valencia (2018).9

The results for normal recessions are displayed in Fig. 5. In contrast, to deep recessions, normal recessions have not statistically significantly effects on TFP and its components. This result is consistent with evidence in Furceri and Mourougane (2012) and Oulton and Sebastià-Barriel (2013).

In Fig. 6, we present the results for deep recessions that are also financial crises. Overall, the results do not point to any systematic difference between “real” deep recessions and “financial” deep recession—if any the results for deep financial crises are less precisely estimated because of fewer episodes. In both cases, TFP declines by about 3 percent in the medium-term, with the persistent effect mostly driven by sectoral re-allocation (the between component).

3.1.2. Country groupings

We examine whether the previous cross-country average effects mask considerable heterogeneity across countries. In particular, given that several studies found that the allocation of resources worsened in southern Europe in the last two decades (e.g., Reis, 2013; Gorton and Ordonez, 2016; Cette et al., 2016; Gopinath et al., 2017), we analyzed whether the effect of recessions on TFP growth varies between this region (Portugal, Spain, Italy and Greece) and others. The results in Fig. 7, while confirming the effect of recession son TFP in most of the economies in our

9 There is a large body of literature on the output costs of a financial crises. Most seem to agree that these crises have severe output effects—Romer (2017) refer to this as “new conventional wisdom”. Cerra and Saxena (2008) and Teulings and Zubanov (2014) argue that output does not rapidly rebound from recessions caused by financial crises. Claessens et al. (2012) find recessions correlated with financial disruptions to be typically longer and deeper than other recessions. Jordà et al. (2013) show that financial recessions are often of longer duration and costlier. More recently, Queralto (2020) found that output, productivity and innovation drop persistently following financial crises and that financial frictions amplify significantly the TFP and output losses following the crisis.
sample, do not point to statistically significant effects in Southern Europe suggesting that lower TFP in these economies has not (at least predominantly) due to previous crises.

3.1.3. Omitted variables
A potential bias is that the probability of a deep recession may be affected not only by past economic growth, but also by countries’ vulnerabilities. For example, excess credit growth and financial frictions may amplify the effects of shocks (Arellano et al., 2018) and lead as a result to output losses being positively correlated to prior economic conditions such as credit growth (Devereux and Dwyer, 2016). Similarly, the level of public debt or current account deficit can shape the response of economic activity to recessions (Jorda et al., 2014).

To address this issue, we re-estimate equation (6) alternatively including as control variables credit growth, the current account balance (in percent of GDP) and the debt-to-GDP ratio. Fig. 7 shows the results for the cyclically-adjusted TFP within and between components and confirms that such augmentations of the vector of controls do not change the basic thrust of our results; that is, TFP goes down following a deep recession and most of that fall is due to between-sector reallocation of

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**Fig. 2.** Macroeconomic Effects of Deep Recessions (percent).

**Fig. 3.** TFP Effects of Deep Recessions (percent).
4. Conclusion and policy implications

In many advanced economies, productivity growth has been declining since the late 1990s and is now at historically low levels. There are worries that the current COVID-19 crisis may exacerbate this negative trend and further reduce total factor productivity growth. While there are different channels through which the current and past crises can lead to permanent productivity losses, one often-cited factor is through sectoral reallocation—that is, the between-sector component of productivity that reflect reallocation of resources across sectors.

This paper provided new evidence on the potential impact of the COVID-19 crisis by examining the effect of past deep recessions on a newly constructed measure of cyclicality adjusted TFP. We find that deep recessions are not only associated with a persistent decline in output and its input of production, but also with permanent TFP losses. In particular, we find that cyclically-adjusted TFP strongly decline in the aftermath of deep recessions with the amplitude of the effect lying between 3 and 4 percent after 3–5 years. This effect comes from both the within and between components of TFP growth, but sectoral reallocation (the between effect) explains most of the medium-term decline in productivity.

Will the COVID-19 lead to similar losses? It is clearly too early to say, and further research will be needed. The crisis will surely lead to some
sectoral reallocation from tourism, restaurants and other services that require in-person contact to sectors such as communication and IT. But the effect on aggregate productivity will much depend on the level of productivity of each of these sectors, which may vary across countries.

Much will also depend on the ability of policies to soften the persistence of the crisis and to reduce scarring effects. In this context, stimulating demand through fiscal and monetary policy and ensuring flow of credit to household and business would be key to mitigate the initial cost of the crisis. Significant fiscal stimulus on high-return investment will be also needed to sustain the recovery and should be complemented with structural reforms aimed at improving efficiency and help ensure resources are reallocated appropriately.

**Declaration of competing interest**

The authors confirm that there is no conflict of interest. All financial support has been properly acknowledged.
Appendix

Table A1
Summary statistics.

| Variable                        | Observations | Average | Standard Deviation | Minimum | Maximum |
|---------------------------------|--------------|---------|--------------------|---------|---------|
| Ln GDP                           | 554          | 13.34   | 1.27               | 11.08   | 16.39   |
| Real GDP growth                  | 554          | 0.0278  | 0.026              | −0.089  | 0.115   |
| Ln employment                    | 554          | 2.45    | 1.198              | 0.123   | 4.99    |
| Ln capital                       | 554          | 14.434  | 1.346              | 11.502  | 17.51   |
| Ln labor productivity            | 554          | 10.89   | 0.29               | 9.62    | 11.49   |
| Ln TFP                           | 578          | −0.048  | 0.128              | −0.581  | 0.256   |
| TFP within                       | 578          | 0.241   | 1.92               | −9.10   | 7.85    |
| TFP between                      | 578          | 0.054   | 2.97               | −18.04  | 15.09   |
| Private credit-to-GDP ratio      | 557          | 89.12   | 38.53              | 26.46   | 214.62  |
| Current account balance (% GDP)  | 566          | −1.46   | 5.86               | −47.94  | 12.93   |

Table A2
List of “Deep Recessions” by country.

| Country            | Years of “deep recession” |
|--------------------|--------------------------|
| United States      | 1980                     |
| United Kingdom     | 1973, 1979, 1990         |
| Denmark            | 1973, 1979               |
| Germany            | 2001                     |
| Netherlands        | 1979                     |
| Canada             | 1981, 1990               |
| Japan              | 1997                     |
| Portugal           | 1974, 1982, 1992         |
| Australia          | 1981                     |
| Finland            | 1990                     |

References

Aaronson, D., Rissman, E., Sullivan, D.G., 2004. Can sectoral reallocation explain the jobless recovery? Econ. Perspect. (Q II), 36–39.
Adler, G., Duval, R., Furceri, D., Klic, G., Koloskova, K., Ribeiro, M., 2017. Gone with the Headwinds: Global Productivity. IMF Staff Discussion Note 17/04.
Aghion, P., Saint-Paul, G., 1998. Virtues of bad times: interaction between productivity growth and economic fluctuations. Macroecon. Dyn. 2 (3), 322–344.
Arlanato, C., Bai, Y., Mihalache, G., 2018. Default risk, sectoral reallocation and persistent recessions. J. Int. Econ. 112, 182–199.
Baily, M., Bartelsman, E.J., Haltiwanger, J., 2001. Labor productivity: structural change and cyclical dynamics. Rev. Econ. Stat. 83 (3), 420–433.
Balbin, B., Weder de Mauro, B. (Eds.), 2020. Economics in the Time of COVID-19, a VoxEU.org eBook. CEPR Press.
Barlevy, G., 2003. Credit market frictions and the allocation of resources over the business cycle. J. Monetary Econ. 50, 1795–1818.
Bartelsman, E., Haltiwanger, J., Scarpetta, S., 2004. Microeconomic Evidence of Creative Destruction in Industrial and Developing Countries. IZA Discussion Papers No 1374.
Basu, S., Fernald, J., Kimball, M., 2006. Are technology improvements contractionary? Am. Econ. Rev. 96 (3), 1418–1448.
Blanchard, O., Cerutti, E., Summers, L., 2015. Inflation and Activity – Two Explorations and Their Monetary Policy Implications. International Monetary Fund. IMF Working Papers 15/230.
Blit, J., 2020. Is Increasing Productivity COVID-19’s Silver Lining? Working Paper Series, No. 30. University of Waterloo, Canadian Labour Economics Forum (CLEF), Waterloo.
Caballero, R.J., Hammour, M., 2014. Productivity and Potential Output before, during, and after the Great Recession. NBER Macroeconomics Annual 2014.
Fernald, J., 2014b. A Quarterly, Utilization-Adjusted Series on Total Factor Productivity. FRBSF Working Paper 2014-19.
Fernald, J., 2016. Reassessing Longer-Run US growth: How Low?. Federal Reserve Bank of San Francisco, WP 2016-18.
Foster, L., Haltiwanger, J., Krizan, C., 2006. Market selection, reallocation and restructuring in the U.S. Retail trade sector in the 1990s. Rev. Econ. Stat. 88 (4), 748–758.
Furceri, D., Mourgou, A., 2012. The effect of financial crises on potential output: new empirical evidence from OECD countries. J. Macroecon. 34 (3), 822–832.
Furceri, D., Mourougane, A., 2012. The effect of financial crises on potential output: new empirical evidence from OECD countries. J. Macroecon. 34 (3), 822–832.
Furceri, D., Mourgou, A., 2012. The effect of financial crises on potential output: new empirical evidence from OECD countries. J. Macroecon. 34 (3), 822–832.
Gopinath, G., Kalemli-Ozcan, S., Karabarbounis, L., Villegas-Sanchez, C., 2017. Capital allocation and productivity in South Europe. Q. J. Econ. 132 (4), 1915–1967.
Gorton, G., Ordouz, G., 2016. Good Boom, Bad Boom. NBER Working Paper No. 22086. University of Pennsylvania.
Gropp, R., Onzena, S., Rochdi, J., Sandi, V., 2020. The Cleansing Effect of Banking Crises. CEPR Discussion Paper No DP15025.
Grossman, G.M., Helpman, E., 1991. Quality ladders and product cycles. Q. J. Econ. 106 (2), 557–586.
 Harding, D., Pagan, A., 2002. Dissecting the cycle: a methodological investigation. J. Monetary Econ. 49 (2), 365–381.
Jorda, O., 2005. Estimation and inference of impulse responses by local projections. Am. Econ. Rev. 95 (1), 161–182.
Jorda, O., Schularick, M., Taylor, A., 2013. When credit bites back. J. Money Credit Bank. 45 (52), 3–28.
Jorda, O., Schularick, M., Taylor, A., 2014. Private Credit and Public Debt in Financial Crises. FRBSF Economic Letter.
Laeven, L., Valencia, F., 2018. Systemic Banking Crises Revisited. IMF Working Paper 18/206.
Mauro, F., Syverson, C., 2020. The Covid Crisis and Productivity Growth. VoxEU piece.
McMillan, M.S., Rodrik, D., 2014. Globalization, structural change and productivity growth. World Dev. 63, 11–32.
Mortensen, D., Pissarides, C., 1994. Job creation and job destruction in the theory of unemployment. Rev. Econ. Stud. 61 (3), 397–415.
Olley, S., Pakes, A., 1996. The dynamics of productivity in the telecommunications equipment industry. Econometrica 64 (6), 1265–1310.
Ono, S., Pappad, F., 2015. Credit frictions and the cleansing effect of recessions. Econ. J. 127 (602), 1153–1178.
Oulton, N., 2013. Long and Short-Term Effects of the Financial Crisis on Labour Productivity, Capital and Output. Bank of England Working Paper no. 470 and Centre for Economic Performance, Discussion Paper no. 1185.
Petrosky-Nadeau, N., 2013. TFP during a credit crunch. J. Econ. Theor. 148 (3), 344–379.
Prais, S.W., Houthakker, H.S., 1955. The estimation of demand functions at the cross section. Rev. Econ. Stud. 22 (3), 115–135.
Queralto, A., 2020. A model of slow recoveries from financial crises. J. Monetary Econ. 114, 1–25.
Reis, R., 2013. The Portuguese slump and crash and the Euro crisis. Brookings Pap. Econ. Act. 46, 143–193.
Restuccia, D., Rogerson, R., 2017. The causes and costs of misallocation. J. Econ. Perspect. 31 (3), 151–174.
Romer, C., Romer, D., 2017. New evidence on the aftermath of financial crises in advanced economies. Am. Econ. Rev. 107 (10), 3072–3118.
Saccone, D., Valli, V., 2009. Structural change and economic development in China and India. Eur. J. Comp. Econ. 1, 101–129.
Tett, G., 2015. Productivity Paradox Deepens Fed’s Rate-rise Dilemma. Financial Times. August 20, 2015.
Teulings, C.N., Zubanov, N., 2014. Is economic recovery a myth? Robust estimation of impulse responses. J. Appl. Econom. 29 (3), 497–514.
Timmer, M., Szirmai, A., 2000. Productivity growth in Asian manufacturing. The structural bonus hypothesis examined. Struct. Change Econ. Dynam. 11 (4), 371–392.
Van Biesebroeck, J., 2005. Exporting raises productivity in sub-Saharan African manufacturing firms. J. Int. Econ. 67 (2), 373–391.
World Bank, 2018. Global Economic Prospects. World Bank, Washington DC. June.