



**A NOTE ON EMPLOYMENT AND WAGE POLARIZATION
IN THE U.S.**

**Fabio Cerina
Alessio Moro
Michelle Rendall**

WORKING PAPERS

2020/02

**CENTRO RICERCHE ECONOMICHE NORD SUD
(CRENoS)
UNIVERSITÀ DI CAGLIARI
UNIVERSITÀ DI SASSARI**

CRENoS was set up in 1993 with the purpose of organising the joint research effort of economists from the two Sardinian universities (Cagliari and Sassari) investigating dualism at the international and regional level. CRENoS' primary aim is to improve knowledge on the economic gap between areas and to provide useful information for policy intervention. Particular attention is paid to the role of institutions, technological progress and diffusion of innovation in the process of convergence or divergence between economic areas. To carry out its research, CRENoS collaborates with research centres and universities at both national and international level. The centre is also active in the field of scientific dissemination, organizing conferences and workshops along with other activities such as seminars and summer schools.

CRENoS creates and manages several databases of various socio-economic variables on Italy and Sardinia. At the local level, CRENoS promotes and participates to projects impacting on the most relevant issues in the Sardinian economy, such as tourism, environment, transports and macroeconomic forecasts.

**www.crenos.unica.it
crenos@unica.it**

CRENoS - CAGLIARI
VIA SAN GIORGIO 12, I-09124 CAGLIARI, ITALIA
TEL. +39-070-6756397; FAX +39-070- 6756402

CRENoS - SASSARI
VIA MURONI 25, I-07100 SASSARI, ITALIA
TEL. +39-079-213511

Title: A NOTE ON EMPLOYMENT AND WAGE POLARIZATION IN THE U.S.

Prima Edizione: Luglio 2020

A Note on Employment and Wage Polarization in the U.S.

Fabio Cerina* Alessio Moro† Michelle Rendall‡

July 2020

Abstract

We compare employment and wage polarization in the U.S. using different sample periods, occupations classification and the inclusion or not of agricultural occupations. We report two main findings. First, we show that employment polarization can emerge together or without wage polarization, depending on the sample period considered. Second, we show that removing agricultural occupations changes the timing of employment polarization, making it emerge earlier, and substantially increases the degree of both employment and wage polarization with respect to the case in which they are included in the sample.

JEL Classification: E20, E21, J16.

Keywords: Employment Polarization; Wage Polarization; Agricultural Occupations.

*University of Cagliari and CRENoS. E-mail: fcerina@unica.it.

†University of Cagliari. E-mail: amoro@unica.it.

‡Monash University. E-mail: michelle.rendall@monash.edu.

1 Introduction

Employment and wage polarization have been extensively studied for the U.S. However, different works typically differ in the sample period, the classification of occupations and in the inclusion or not of agriculture occupations. In this note we aim at rationalizing the results emerging from different choices, by taking as reference four works: [Acemoglu and Autor \(2011\)](#), [Acemoglu and Autor \(2012\)](#), [Autor and Dorn \(2013\)](#) and [Bárány and Siegel \(2018\)](#). We compare different methodologies by using the typical smoothed graphs of changes in employment shares and wages by 1980 percentiles of occupations, which are used in these works.

A first question that we ask is whether employment polarization is always accompanied by wage polarization. We find that answer is no, as a similar pattern of employment polarization in the U.S. can emerge both together and without wage polarization depending on the time period studied.

Next, we ask whether the choice of the classification might determine the extent of employment polarization. Several researchers use the occupations classifications developed by [Dorn \(2009\)](#) to analyze the period 1980-2008, as this provides a consistent set of occupations existing in the sample period, by harmonizing the IPUMS classifications over different decades. However, to analyze employment polarization in the pre-1980 period such classification cannot be used, because some 1980 occupations did not exist before that year. [Bárány and Siegel \(2018\)](#) provide an alternative classification of occupations which addresses this issue. With respect to [Dorn \(2009\)](#), they merge occupations into broader categories, in such a way that these new occupation categories in the analysis exist from 1950 to 2008. Here we ask whether this procedure has implications for the measurement of employment polarization in the 1980-2008 period and find a negative answer. While the number of occupations categories is largely reduced in [Bárány and Siegel \(2018\)](#), the pattern of employment and wage polarization is similar to that obtained using [Dorn \(2009\)](#) occupational classification.

Finally we address the role of agricultural occupations. Some works, like [Acemoglu and Autor \(2011\)](#) and [Acemoglu and Autor \(2012\)](#) include agricultural occupations in constructing employment polarization graphs, while some others, like [Autor and Dorn \(2013\)](#) and [Bárány and Siegel \(2018\)](#), exclude them. We note here that, although the value added and consumption shares of agriculture are already substantially low in the U.S. in 1980, the employment shares of agricultural *occupations* is not negligible (2.88%). It follows that their role can be substantial when measuring employment polarization, especially at the bottom of the skill distribution where agricultural occupations are concentrated in 1980. In particular, we show that removing agricultural occupations magnifies the extent of employment polar-

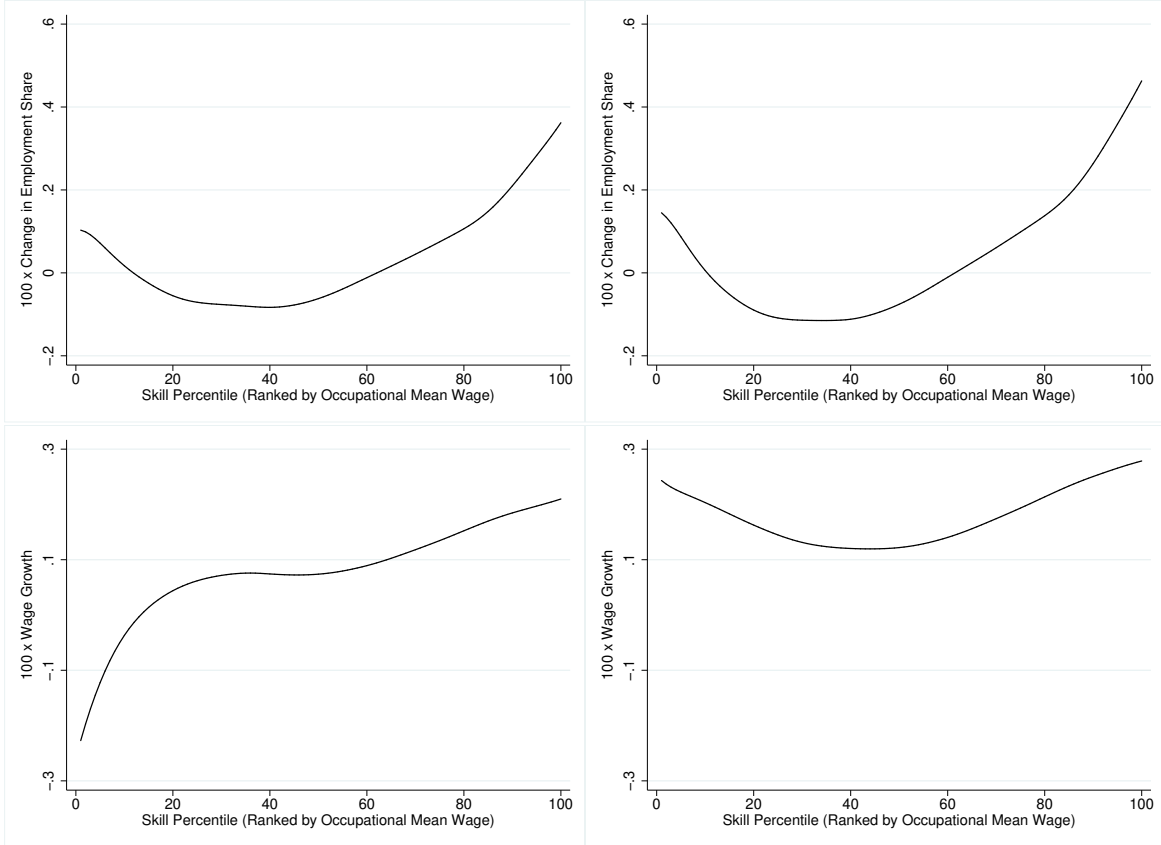


Figure 1: Employment (top) and Wage Polarization (bottom); 1980-2008 (left) and 1980-2017 (right). Occupations classification is from [Dorn \(2009\)](#).

ization by creating a larger increase of employment shares at the bottom of the distribution, compared to the case in which these occupations are included. Regarding wages, we find no evidence of polarization when agriculture occupations are included in the sample, while some wage polarization emerges when agricultural occupations are excluded.

The remainder of the note is as follows: Section 2 shows that employment polarization can occur both together and without wage polarization; Section 3 compares the results obtained with the classifications of occupations in [Dorn \(2009\)](#) and [Bárány and Siegel \(2018\)](#); Section 4 shows the effect of removing agricultural occupations. Finally, Section 5 concludes.

2 Employment and Wage Polarization

In this section we show that employment polarization can emerge together or without wage polarization. We use [Acemoglu and Autor \(2011\)](#) codes and [Dorn \(2009\)](#) classification.¹

¹This methodology includes agricultural occupations.

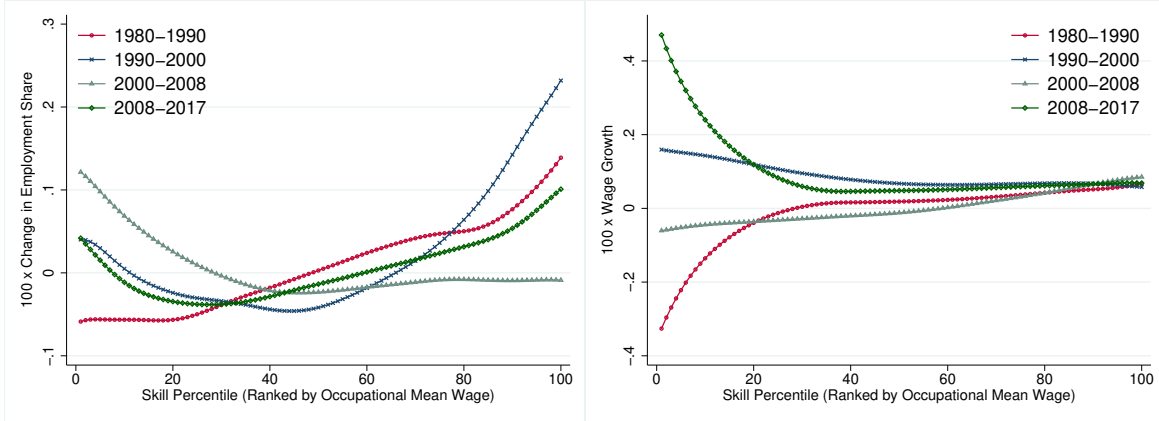


Figure 2: Employment and Wage Polarization: Top-left EP AA 1980-2008; top-right WP AA 1980-2008; bottom-left EP AA 1980-2017; bottom-right WP AA 1980-2017

Figure 1 reports employment and wage polarization for two different data sample: 1980-2008 and 1980-2017. The figure highlights that while employment polarization is similar in the two samples, displaying the typical U-shape in both, the pattern of wages is substantially different. This shows an almost monotone increasing behavior for the 1980-2008 period and a clear U-shape for the 1980-2017 period.²

Obviously, the difference between the two figures is given by the additional decade included in the second sample. To better show the contribution of the additional data, Figure 2 reports employment and wage polarization by decade for the period 1980-2017.³ The period 2008-2017 displays a behavior of employment polarization which is similar to that of the 1990-2000 in the bottom part of the skill distribution, and similar to that of the 1980-1990 in the upper part of the distribution. For this reason, adding this decade to the 1980-2008 period does not change the shape of employment polarization, while it affects the magnitude. Instead, the pattern of wage polarization is substantially different across decades. In particular, this is true for the bottom of the skill distribution, rather than for the top, which behaves similarly across the four decades. The last decade (2008-2017) displays a substantial increase in wages at the bottom of the distribution, something in stark contrast with the other periods. Among the latter, in fact, only the 1990-2000 displays an increase at the bottom of the distribution, and this increase is substantially smaller than the 2008-2017 period.

Particularly relevant appears the comparison between the periods 1990-2000 and 2008-2017. In fact, while both periods display a similar magnitude of employment polarization at

²ACS 2008 reports wages from 2007, so the Great Recession does not affect the results.

³For the sake of exposition we admittedly abuse terminology along the text by referring also to the 2000-2008 as a decade.

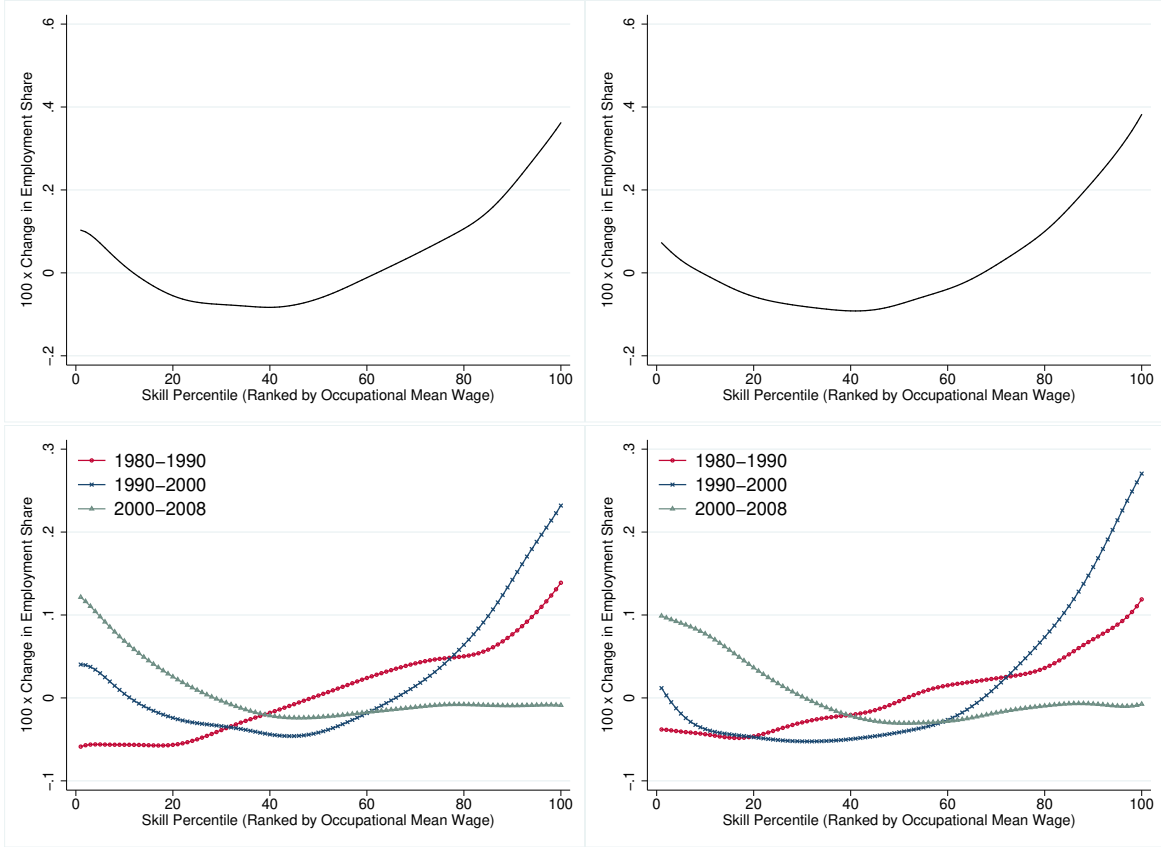


Figure 3: Employment Polarization during the 1980-2008 using the occupations classification in [Dorn \(2009\)](#) and [Bárány and Siegel \(2018\)](#). Left: AA; right BS.. Top: 1980-2008; bottom: decades.

the bottom of the distribution, this is not mirrored by a similar change in wages in that part of the skill distribution, with the later period displaying a substantially stronger increase. In addition, analyzing the 1980-1990 and the 2000-2008, it appears that either combination of changes in employment and wages can occur at the bottom of the skill distribution: i) a *higher* increase of employment shares and a *smaller* increase in wages at the bottom of the distribution with respect to the 1990-2000 and 2008-2017 periods, which is the case of the 2000-2008 period; or ii) a *smaller* increase of employment shares and a *smaller* increase in wages at the bottom of the distribution with respect to the 1990-2000 and 2008-2017 periods, which is the case of the 1980-1990 period.

3 Different classifications

[Bárány and Siegel \(2018\)](#) study employment and wage polarization since 1950. In this case, the occupations classification in [Dorn \(2009\)](#) cannot be used, because some of the occupations

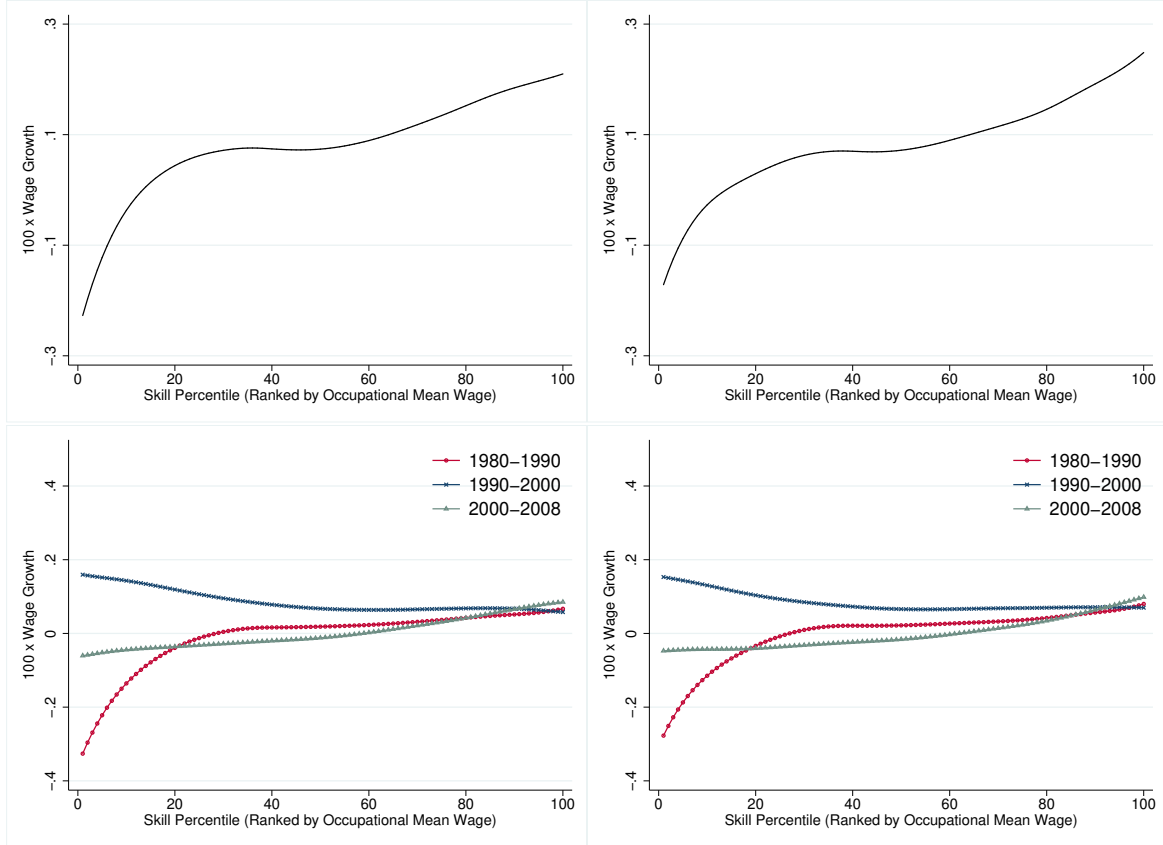


Figure 4: Wage evolution during the 1980-2008 using the occupations classification in [Dorn \(2009\)](#) (left) and [Bárány and Siegel \(2018\)](#) (right). Top: 1980-2008; bottom: decades.

existing in 1980 do not exist in the previous decades. Thus, [Bárány and Siegel \(2018\)](#) create a new classification by merging occupations in 1980 into a smaller set (183 occupations) than in [Dorn \(2009\)](#) (326 occupations). In this way, occupations that appear only in a subperiod and not in another one, are now included in a broader occupation category that is present in the whole sample period 1950-2008. While this procedure is guided by the need to analyze a broader period, we investigate here whether it generates differences in measured employment polarization in the 1980-2008 period with respect to the more disaggregated classification used in [Dorn \(2009\)](#).⁴

Figure 3 compares the two methodologies. In the first row, we report employment polarization for the 1980-2008 period, which is the time span considered in both papers.⁵ Both the qualitative and quantitative pattern is similar for the two methodologies. This is confirmed by the second row in Figure 3, which compares decades in the period 1980-2008. There

⁴Technically, we use the code in [Acemoglu and Autor \(2011\)](#), and apply to it the occupation classification in [Bárány and Siegel \(2018\)](#), downloadable at <https://www.aeaweb.org/articles?id=10.1257/mac.20150258>.

⁵Results for the 1980-2017 are similar and available upon request.

is some discrepancy between the two methodologies at the bottom of the distribution for the period 1990-2000. Apart from this, the pattern is very close for each decade and each methodology. Figure 4 shows that the two occupations classifications display similar results also in terms of wages.

4 Including and excluding agriculture

In this section we study the role of agricultural occupations.⁶ The literature does not explicitly discuss the role of these type of occupations in generating employment polarization, and there are cases in which these are included, as in [Acemoglu and Autor \(2011\)](#) and [Acemoglu and Autor \(2012\)](#), and cases in which they are excluded, as in [Autor and Dorn \(2013\)](#) and [Bárány and Siegel \(2018\)](#).⁷

Although the value added and consumption shares of agriculture are already substantially low in the U.S. in 1980, the employment share of agricultural *occupations* (2.88%) is not negligible when considering occupational percentiles. In addition, since occupations are typically ranked by mean wages in 1980, agricultural occupations are located at the bottom of the skill distribution. For these reasons, it turns out that the choice of including or not these occupations is quantitatively relevant for measured employment and wage polarization. Figure 5 reports employment polarization measured using both the classification in [Dorn \(2009\)](#) and [Bárány and Siegel \(2018\)](#) by including and excluding agriculture. The main difference is that when agricultural occupations are excluded the increase of employment shares at the bottom of the distribution is larger. Figure 6 shows that this is true for each decade in the 1980-2008 period. Thus, the exclusion of agriculture occupations has two main effects: i) it shifts back in time the emergence of employment polarization; and ii) it magnifies the extent of it. The anticipation of the emergence of employment polarization is even more evident when reconstructing Figure 5 in [Acemoglu and Autor \(2012\)](#), which we do in Figure 7. When agricultural occupations are included, employment polarization emerges clearly from 1990 onwards. When these are excluded, there is employment polarization in both periods. This is due to the fact that employment shares of agricultural occupations decline over the period and that they are located at the bottom of the skill distribution in

⁶Agricultural occupations are those included in group D named “Farming, Forestry, and Fishing Occupations” in the occ1990dd classification in [Dorn \(2009\)](#) with codes 473 to 498.

⁷[Acemoglu and Autor \(2011\)](#) and [Acemoglu and Autor \(2012\)](#) do not explicitly discuss the inclusion of agricultural occupations in their sample when constructing, respectively for the two works, their Figure 10 and Figure 5. However, this can be inferred by comparing Figure 10 in [Acemoglu and Autor \(2011\)](#) with the top of our Figure 6 below. The same applies to Figure 5 in [Acemoglu and Autor \(2012\)](#) and our Figure 7 below. For all graphs we use codes downloaded from Daron Acemoglu’s website (<https://economics.mit.edu/faculty/acemoglu/data/handchapter>).

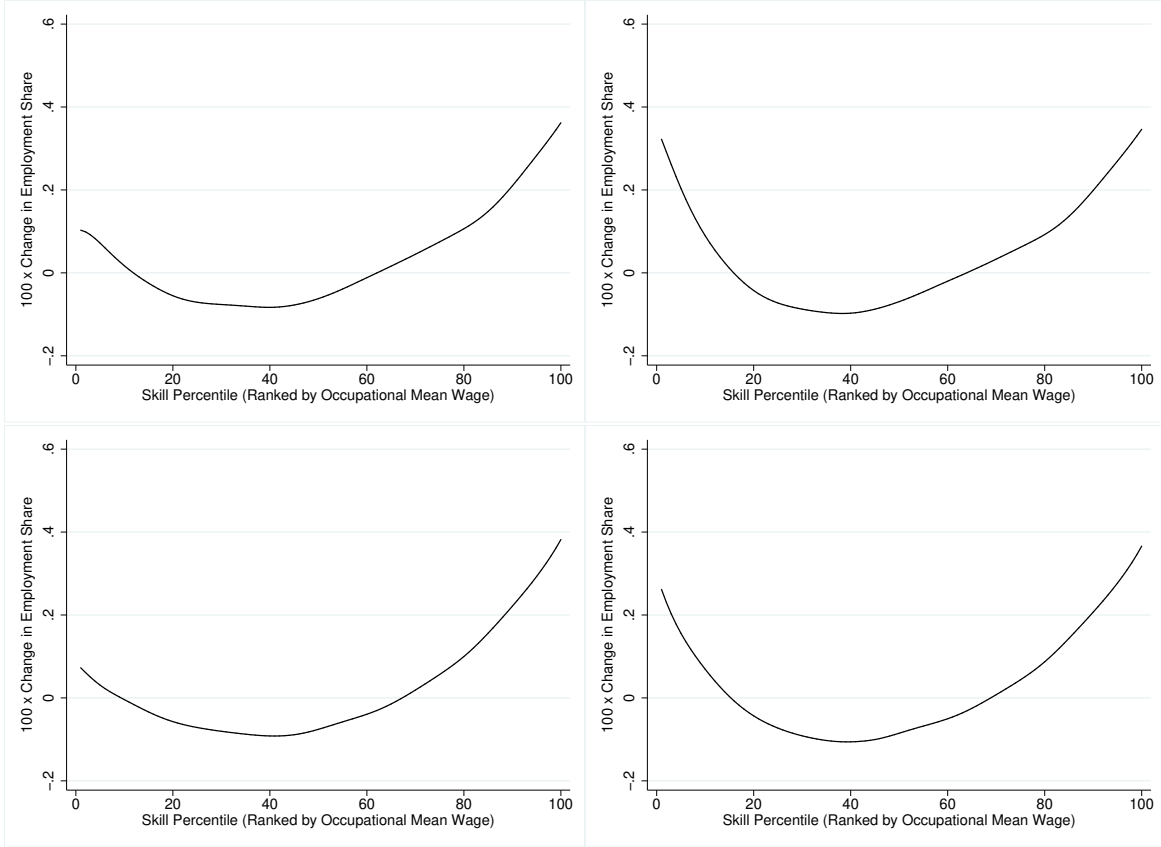


Figure 5: Employment Polarization in 1980-2008 using the classification in [Dorn \(2009\)](#) (top) and [Bárány and Siegel \(2018\)](#) (bottom), including (left) and excluding (right) agriculture occupation categories.

1980. Thus, removing them reduces the downward pressure on employment shares at the bottom of the distribution.

Figure 8 reports the evolution of wages in the two cases. When agriculture is included there is no wage polarization. This mildly emerges when agriculture is excluded from the sample. Thus, while for employment polarization the choice of including or not agriculture has only a quantitative effect, being employment polarization maintained in the two cases, for wage polarization to emerge in the 1980-2008 period agriculture occupations have to be dropped from the sample.

Finally, Figure 9 reports the effect of including or excluding agricultural occupations when computing employment polarization for the 1960-1980 period. In this case, we use the classification by [Bárány and Siegel \(2018\)](#). The Figure shows that including agriculture occupations, there is a large decline of employment shares at the bottom of the distribution. This reflects the substantial disappearance of agriculture employment during this period in the U.S., as the employment share of agricultural occupations declines from 7.34% in

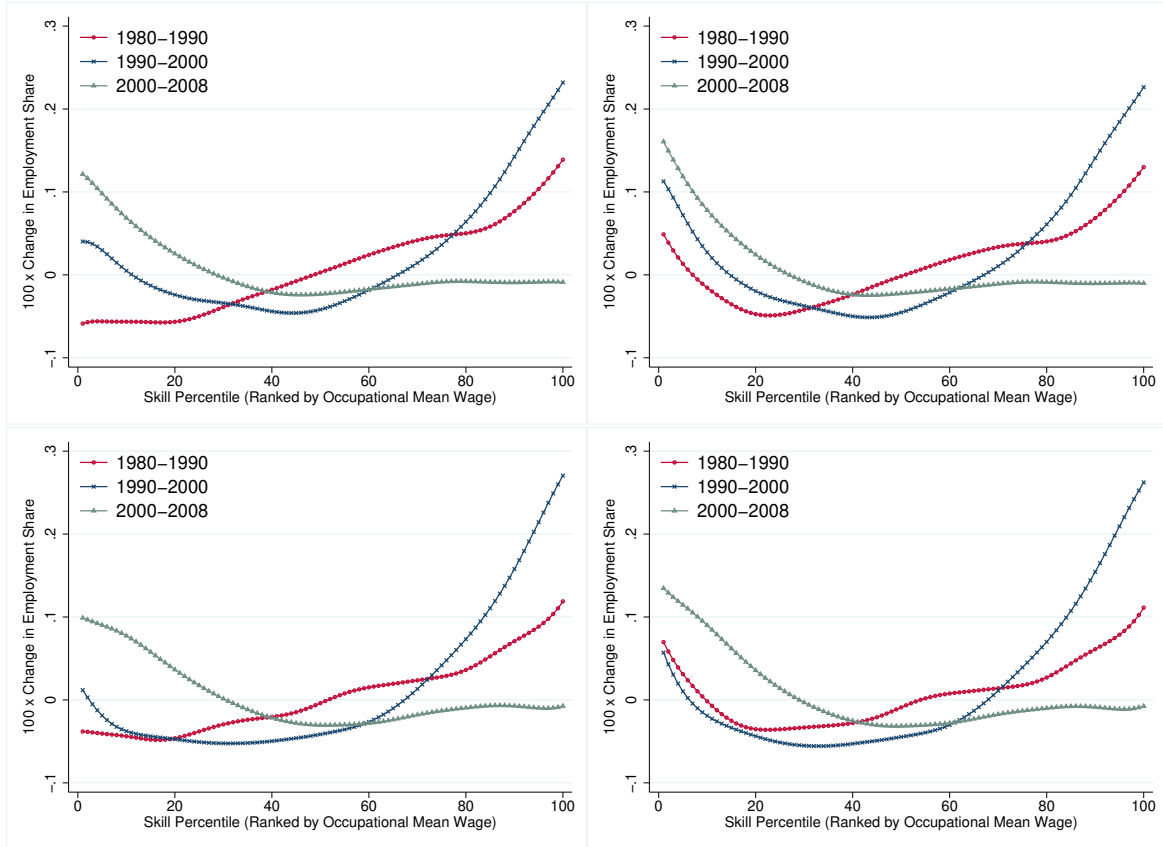


Figure 6: Employment polarization by decades during the 1980-2008 using the classification in Dorn (2009) (top) and Bárány and Siegel (2018) (bottom), including (left) and excluding (right) agriculture occupation categories.

1960 to 2.88% in 1980. By removing agriculture occupations, the large drop at the bottom disappears, and a U-shape can be appreciated, albeit substantially weaker than for the 1980-2008 period.⁸ Thus, the U.S. economy displays some employment polarization before 1980 only if agriculture occupations are excluded. If they are included, there is no employment polarization whatsoever. However, dropping agricultural occupations for the period 1960-1980 implies removing a large fraction of the labor force.

5 Conclusions

In this note we compare different approaches to the measurement of employment and wage polarization, and we report the following main findings. First, employment polarization can be associated or not to wage polarization. The data show that employment shares at the

⁸The pattern reported in the right panel of Figure 9 for the the 1960-1980 for the overall economy can be compared with the pattern for the 1950-1980 in Figure 1 in Bárány and Siegel (2018).

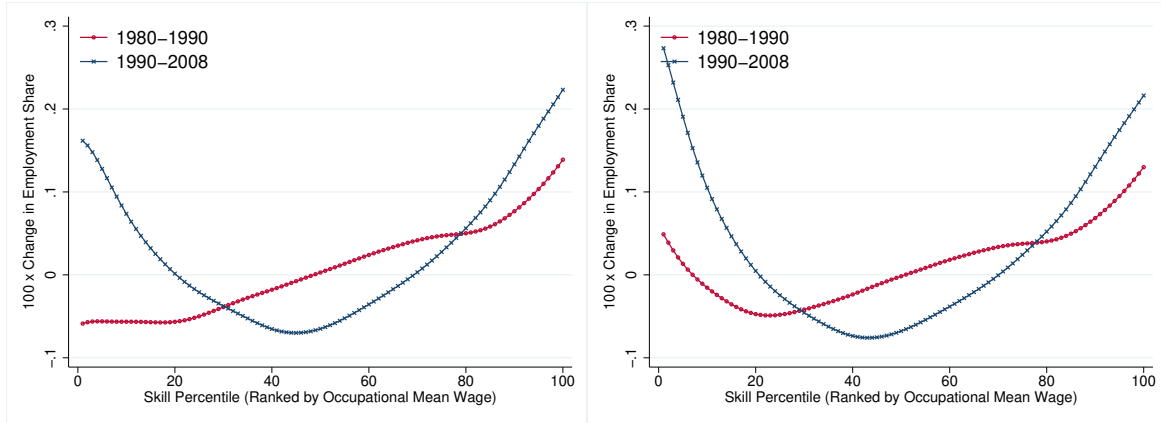


Figure 7: Employment polarization in the subperiods 1980-1990 and 1990-2008 by including (left) and excluding (right) agriculture occupation categories. The occupations classification is [Dorn \(2009\)](#).

bottom of the skill distribution can increase together or without an increase in wages in that part of the distribution. Intuitively, the joint behavior of employment and wages should reflect the evolution of supply and demand of labor in that part of the skill distribution. An increase in employment shares coupled with an increase in wages could signal a stronger labor demand effect, while a decrease in wages the opposite, i.e. a stronger labor supply effect.

Second, excluding agricultural occupations makes employment polarization appear earlier, as it magnifies the increase in employment shares at the bottom of the skill distribution in all sub-periods, and induces the emergence of wage polarization in the 1980-2008 period. In addition, the exclusion of agriculture occupations is key for the emergence of employment polarization in the 1960-1980 period. When agriculture occupations are included there is no employment polarization before 1980.

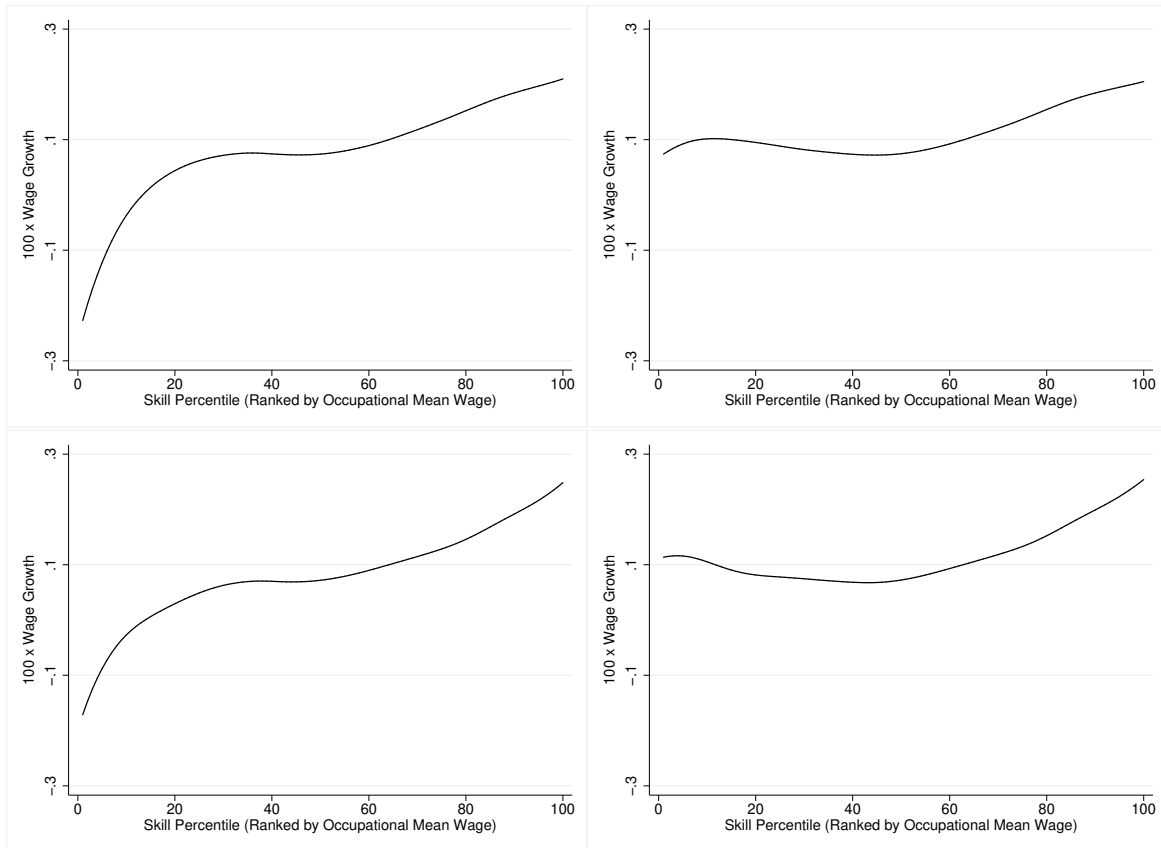


Figure 8: Wage evolution. Top: [Acemoglu and Autor \(2011\)](#); Bottom: [Bárány and Siegel \(2018\)](#); left: with agriculture; right: without.

References

- ACEMOGLU, D., AND D. AUTOR (2011): “Chapter 12 - Skills, Tasks and Technologies: Implications for Employment and Earnings,” vol. 4, Part B of *Handbook of Labor Economics*, pp. 1043 – 1171. Elsevier.
- (2012): “What does human capital do? A review of Goldin and Katz’s *The race between education and technology*,” *Journal of Economic Literature*, 50(2), 426–463.
- AUTOR, D. H., AND D. DORN (2013): “The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market,” *American Economic Review*, 103.
- BÁRÁNY, Z. L., AND C. SIEGEL (2018): “Job polarization and structural change,” *American Economic Journal: Macroeconomics*, 10(1), 57–89.
- DORN, D. (2009): “Essays on Inequality, Spatial Interaction, and the Demand for Skills,” Ph.D. thesis, University of St. Gallen.

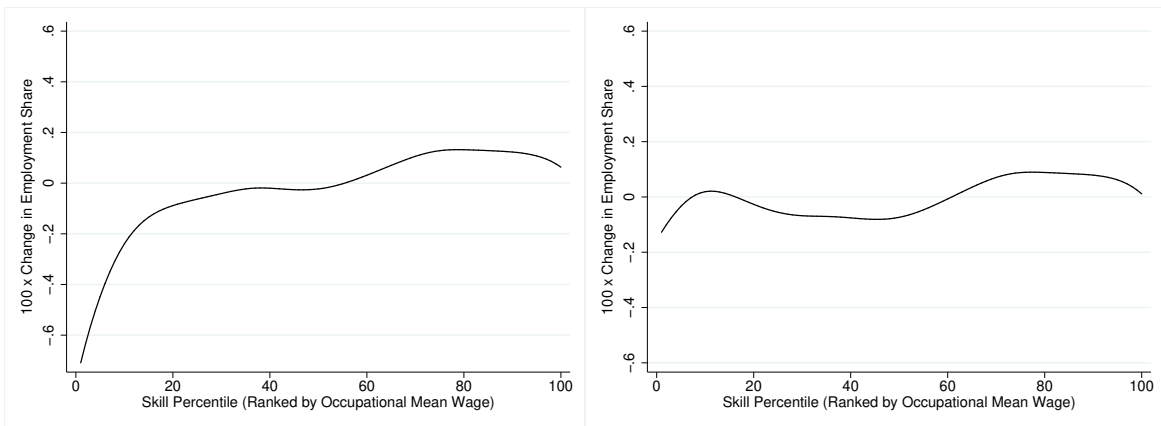


Figure 9: Employment Polarization in the 1960-1980 period. Left: including agriculture occupations; right Excluding agriculture occupations.

Ultimi Contributi di Ricerca CRENoS

I Paper sono disponibili in: <http://www.crenos.unica.it>

- 20/01 *Elias Carroni, Dimitri Paolini*, “Business models for streaming platforms: content acquisition, advertising and users”
- 19/16 *Daniela Sonedda*, “Regional variation in apprenticeship and permanent employment rates: which causes?”
- 19/15 *Daniela Sonedda*, “Regional disparities in the functioning of the labour markets”
- 19/14 *Bianca Biagi, Barbara Dettori, Raffaele Paci, Stefano Usai*, “Economic development in Sardinia: overcoming the insularity gap”
- 19/13 *Miguel Casares, Luca Deidda, Jose E. Galdon-Sanchez*, “On financial frictions and firm market power”
- 19/12 *Massimiliano Bratti, Maurizio Conti, Giovanni Sulis*, “Employment Protection and Firm-provided Training: Quasi-experimental Evidence from a Labour Market Reform”
- 19/11 *Jessica Goldberg, Mario Macis, Pradeep Chintagunta*, “Incentivized Peer Referrals for Tuberculosis Screening: Evidence from India”
- 19/10 *Julio J. Elias, Nicola Lacetera, Mario Macis*, “Paying for Kidneys? A Randomized Survey and Choice Experiment”
- 19/09 *Fabio Cerina, Elisa Dienesch, Alessio Moro, Michelle Rendall*, “Spatial Polarization”
- 19/08 *Michele Battisti, Massimo Del Gatto, Christopher F. Parmeter*, “Skill Biased Technical Change and Misallocation: a Unified Framework”
- 19/07 *Fabrizio Fusillo, Francesco Quatraro, Stefano Usai*, “Going Green: Environmental Regulation, eco-innovation and technological alliances”
- 19/06 *Oliviero A. Carboni, Giuseppe Medda*, “External R&D Acquisition and Product Innovation”
- 19/05 *José J. Cao-Alvira, Luca G. Deidda*, “Development of Bank Microcredit”
- 19/04 *Vania Licio*, “When history leaves a mark: a new measure of Roman roads”
- 19/03 *Simone Franceschini, Gerardo Marletto*, “Reorganization of supply chains as a key for the envision of socio- technical transitions. The case of tourism”
- 19/02 *Elias Carroni, Dimitri Paolini*, “The business model of a streaming platform”
- 19/01 *Stefania Capecchi, Marta Meleddu, Manuela Pulina, Giuliana Solinas*, “Mixture models for consumers’ preferences in healthcare”
- 18/13 *Adelaide Baronbelli, Teodora Erika Uberti*, “Exports and FDI: Comparing Networks in the New Millennium”
- 18/12 *Gabriele Cardullo, Maurizio Conti, Giovanni Sulis*, “Unions, Two-Tier Bargaining and Physical Capital Investment: Theory and Firm-Level Evidence from Italy”
- 18/11 *Jing Guan, J.D. Tena*, “Estimating the Effect of Physical Exercise on Juveniles’ Health Status and Subjective Well-Being in China”
- 18/10 *Silvia Balia, Rinaldo Brau, Daniela Moro*, “Hospital choice with high long-distance mobility”
- 18/09 *Luca Deidda, Ettore Panetti*, “Banks’ Liquidity Management and Financial Fragility”
- 18/08 *Gerardo Marletto, Cécile Sillig*, “Lost in mainstreaming? Agrifood and urban mobility grassroots innovations with multiple pathways and outcomes”
- 18/07 *Jing Guan, J.D. Tena*, “Do Social Medical Insurance Schemes Improve Children’s Health in China?”

www.crenos.unica.it