PSL Quarterly Review

vol. 72 n. 290 (September 2019)

Original article

Rising wage differential between white-collar and blue-collar workers and market concentration: The case of the USA, 1964-2007

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Abstract:

I suggest that market concentration at aggregate level has a significant structural impact on the wage differential between white-collar and blue-collar workers. Both phenomena are increasing as larger firms are more inclined to employ and pay more white-collar workers, in order to increase and/or maintain their market share by way of innovative tasks carried out by white-collars such as R&D, design and product differentiation, financial/capital market operations, market research, advertising and sales operations, etc. The causality from market concentration to wage differential runs through an effective demand channel and one based on the diffusion of innovations. The innovative contribution of the paper is to reveal this relationship of structural causality, and to provide a new measurement of aggregate market concentration which is calculated as the reverse of the break-even point. The argument is tested for the case of the USA between 1964 and 2007 using Vector Error Correction Model. The findings confirm the existence of a long-run positive relationship from market concentration in the nonfinancial corporate sector to the wage differential.

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How to cite this article:
Dögüs I.: (2019), "Rising wage differential between white-collar and blue-collar workers and market concentration: The case of the USA, 1964-2007", *PSL Quarterly Review*, 72 (290):223-251

DOI: https://doi.org/10.13133/2037-3643_72.290_4

JEL codes:
L1, D4, J31

Keywords:
market concentration, wage differential, white-collar, blue-collar workers

Journal homepage:
http: //www.pslquarterlyreview.info

> *… [T]he struggle about money-wages primarily affects the distribution of the aggregate real wage between different labour-groups, and not its average amount per unit of employment, which depends, as we shall see, on a different set of forces. The effect of combination on the part of a group of workers is to protect their relative real wage. The general level of real wages depends on the other forces of the economic system.*
>
> (Keynes, 1936, p. 14)

The global economy has experienced several structural changes to characterize the last decades: rise of inequality, expansion of financial sector, fragmentation of production, dominance of big corporations, i.e., market concentration and rise of ancillary (overhead) labour, i.e., white-collar jobs, etc. There have been immense debates in the social sciences on

the relationships between these phenomena, except the relationship between market concentration and the relative higher growth of salaries of white-collar workers compared to wages of blue-collar production workers. This paper aims to examine the relationship between wage inequality between white-collar and blue-collar workers and market concentration (see figure 1), which has not hitherto been elaborated in the literature, by focusing on the USA case, since it is a prominent one.

From 1964 to 2007 wage inequality between white-collar and blue-collar workers increased by 32%, as depicted by figure 1. The wage differential between the 90th and the 50th percentiles and the college premium has also significantly increased in the last four decades (see figure 5). Regarding the increase in market concentration, an April 2016 *Issue Brief* of the Council of Economic Advisers (CEA)[1] reports an increase in market concentration in the US and that "for 1977-2013 firm entry rates have declined over time, whereas firm exit rates have been more or less steady" (CEA, 2016, p. 5). "[B]y using plant-level data from the U.S. Census Bureau covering the entire manufacturing sector over the 1997 to 2007 period," Blonigen and Pierce (2016, p. 4) of the Federal Reserve Board found that "evidence for increased average markups from mergers and acquisitions (M&A) activity is significant and robust" (ibid., p. 24). In addition, some New-Keynesian studies[2] have documented the rise in mark-up in the US due to increased market concentration at the macro level. For example, the aggregate price-cost mark-up calculated by Nekarda and Ramey (2013, p. 11) has a similar path as my own calculation of market concentration (see figure 1) by way of the reverse of the break-even point in the non-financial sector, which will be discussed in detail in the empirical section. Grullon et al. (2019) found that, since the late 1990s, over 75% of US industries have experienced an increase in concentration levels. Other datasets that confirm the increase in market concentration in the US at the macro level are as follows: percentage of US manufacturing industries in which the largest four companies accounted for at least 50 percent of shipment value in their industries (Foster et al., 2011) and asset share of the top 100 firms (Brennan, 2016, p. 16).

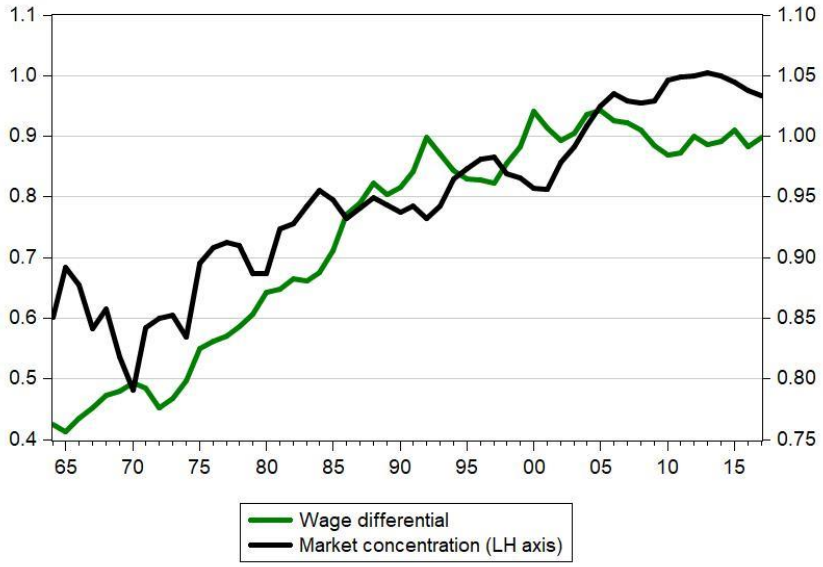
Starting from the fact that "the top-end wage inequality has increased more than low-end wage inequality" (Lemieux, 2008), in accordance with the question 'What types of employees have been steadily paid more by what type of employers?', the innovative contribution of this paper is not just to argue that white-collar workers would be employed and paid more by big price-making firms than by small price-taking firms while blue-collar workers in production tasks would be employed and paid more mostly by competitive price-taking small- and medium-sized enterprises (SMEs) – which is the fact (Galbraith, 1967); rather it proposes that the increase in market concentration at the macro level, where the market power and market share of big firms increases, leads structurally to a rising wage inequality between white-collar and blue-collar workers. Put differently, the special focus of the paper[3] is if inequality among capitalists leads to inequality among two specific groups of workers; it does not deal with the falling labour share and the stagnancy of overall wages due to the increase in market concentration (see Autor et al., 2017; Wilmers, 2018).

[1] Available at https://www.whitehouse.gov/administration/eop/cea

[2] See Gali (1994), Gali et al. (2007), Nekarda and Ramey (2013), Afonso and Jalles (2015), De Loecker et al. (2017), and Eggertsson et al. (2018).

[3] The question as to whether the change in market concentration is the main factor and Skill-Biased Technological Change (SBTC) and institutional changes are merely secondary factors calls for further research. See Güven and Turanlı (2014) for an analysis incorporating market structure and SBTC in the case of Turkey.

Figure 1 – *Market concentration and wage differential between white-collar and blue-collar workers*



Notes: Market concentration is calculated as the reverse of the break-even point of US-nonfinancial corporations.
Source: Based on fred.stlouisfed annual datasets, 1964-2007, annual data, USA. Wage differential is calculated as the ratio of annual average hourly compensation of all employees in the non-financial corporation (NFC) sector to the average hourly earnings of production workers in the private sector.

The argument relies theoretically on the post-Keynesian approach, especially Minsky's understanding of the output-price setting of price-taker and price-maker firms: In contrast to dominant price-maker firms, "price-taking firms will tend to have smaller overhead and validating costs of capital per unit of output than price-making firms" (Minsky, 1986, p. 181). In keeping with this conception, I do not discuss firm-size wage premiums among the same type of workers or intra-firm wage premiums (see Jirjahn and Kraft, 2007), but rather a structural change in the market that causes a wage differential among workers performing different tasks at the macro-level. The causal nexus of the relatively higher growth of salaries of white-collar workers due to market concentration can be explained by remembering that employment and thus wage growth are mainly demand-driven (Keynes, 1936) and that competition in innovation and hence diffusion of innovations across sectors creates a higher demand for white-collar workers.

This is not to say that I reject here the impact of international trade (Antenucci, 2018), 'offshorability' (Firpo et al., 2011), computerization (Van Reenen, 2011; Acemoglu and Autor, 2010) and institutional changes (Kristal and Cohen, 2016) on wage inequality. What I try to show is that market structure also has a significant impact on wage differential[4], particularly

[4] The relationships between market concentration at the aggregate level and both institutional changes (such as unionization, regulations, minimum wage, etc.) and technological changes lie outside the scope of this paper. For a discussion of the relationship between market concentration and unionization, see Hodson (1983), Conyon (1992; 1994), and Henley (1987), as well as Gordon (1998). De-unionization might be associated with the increase in the share of white-collar workers (see figure 3), who have a relatively lower tendency to unionize (Aghion et al., 2001; Mishel, 2012). See footnote 10 for suggested readings on the relationship between competition and innovation.

between white-collar and blue-collar workers, based on the assumption that market structure differentiates the needs of employers for some types of occupations and thereby differentiates the struggle about money-wages among employees.

The hypothesis that rising market concentration at the macro level has caused the rise of the wage differential between white-collar and blue-collar workers in a direct and long-run structural manner in the case of the US will be tested by way of US annual data for the period between 1964 and 2007 using Vector Error Correction (VEC) model.

The paper is structured as follows. Section two gives a brief review of the literature. Section three deals with the theoretical explanation as to why white-collar workers' salaries and employment share have a tendency to be higher in concentrated markets than those of blue-collar workers. Section four tests the argument empirically. Finally, the last section draws conclusions.

1. Review of the literature

The stagnancy of wages in the last decades in the US (Pew Research, 2014)[5] refers to the observation of overall average wages. However, the decomposition of real wages reveals that, whereas the real hourly wages of the 10th percentile have decreased by 6,77% and of the 50th percentile by 5,98% from 1980 to 2011, the real hourly wages of the 90th percentile have increased by 28,6% during the same period (stateofworkingamerica.org; figure 4C). The share of the top 1% of wage-earners in the US has increased from 7,7% in 1980 to 14,1% in 2007.[6]

Two main approaches on wage inequality dominate the literature. Whereas the SBTC approach[7] identifies the computerization of production as the main reason behind wage inequality, according to the alternative approach, which I call the Institutional Change approach,[8] rising wage inequality has been mainly driven by institutional changes (such as de-unionization, stagnating real minimum wages, performance-based pay, deregulation of labour markets, decentralisation of collective agreements [Wallerstein, 1999], a declining share of the government sector in employment, etc.). Kristal and Cohen claim that "the decline of pay-setting institutions is almost twice as important as technology-driven demand for skilled labour in explaining rising inequality within US industries" (Kristal and Cohen, 2016, p. 21).

In short, the debate is about whether the rising wage inequality has been driven by market forces or non-market forces. However, this debate has neither adequately considered the impact of change in market structure on wage inequality nor its impact on market and non-market forces. Both approaches fail clearly to indicate what types of firms have been paying superior wages to a high-skilled labour force. They rely on assumptions that are appropriate to an average representative firm.

Lin and Tomaskovic-Devey (2013) and the outdated contributions of Irfan (1979), Allen (1968), and Jones and Laudadio (1975) are the only studies that I could find that consider the

5 http://www.pewresearch.org/fact-tank/2014/10/09/for-most-workers-real-wages-have-barely-budged-for-decades/

6 http://stateofworkingamerica.org/chart/swa-wages-figure-4g-share-total-annual-wages/

7 See Acemoglu (1998; 1999; 2003), Acemoglu and Autor (2010), Aghion et al. (2001), Aghion and Howitt (2002), Autor et al. (2005; 2008), Autor (2014), Burstein et al. (2016), Katz (1999), and Van Reenen (2011).

8 See Card (2001), Card and DiNardo (2002), Card et al. (2004), DiNardo et al. (1996), Freeman (1982; 1993; 2005), Herr et al. (2014), Kristal and Cohen (2016), Lemieux (2008), Sjöberg (2008), Wallerstein (1999), and Wallerstein and Western (2000.

relationship between market structure and wage differentials. However, their analyses refer to concentration at the sectoral level and wage dispersion between industries, not at the macro level, as discussed in this paper.

Allen (1968) and Irfan (1979) cannot support their hypotheses through empirical analyses. Irfan (1979, p. 40) found that market concentration (measured by the share of the four largest firms) had an only marginally significant (10% level) and weak impact on wage inequality in Pakistan between 1969 and 1971. Allen (1968) concludes that

> What is not clear is whether the source of these relative wage gains has been the product-market monopoly power of the firms involved. In part, the observed relation between concentration and wage increases may have been spurious (Allen, 1968, p. 365).

Using the Canadian dataset for the period between 1965 and 1969, Jones and Laudadio (1975) found that goods market imperfection has a role on wage differentials by way of higher unionization in concentrated sectors. But they did not employ the same theoretical reasoning as used in this paper and they did not focus on the macro level. Allen concludes that "concentration was significantly and almost continuously associated with larger annual increases in earnings from 1951 to 1962" (Allen, 1968, p. 359).

Lin and Tomaskovic-Devey (2013), on the other hand, do not take into account concentration as a leading decisive factor. Rather, they employ it in their regression only as a control variable and find that it has a negative relationship with wage inequality, even though they also found that it has a positive impact on managerial pay.

Autor et al. (2005) consider changing employment composition with regard to rising upper-end wage inequality. They do not, however, take into account the rise of higher-paid white-collar workers as a function of an increase in market concentration at the macro level. Antonczyk et al. (2010) found that, in the case of western Germany between 2001 and 2006, firm size played only a small role in wage inequality (Antonczyk et al., 2010, pp. 21 and 40). Card et al. (2018) claim that firm size matters for wage inequality with regard to productivity differences for the same occupation groups; but they do not deal with the rise in market concentration and change in the composition of occupations (i.e., with respect to white- and blue-collar workers). Kristal and Cohen (2016, pp. 18-20) find that employment in big firms declines and explains only a minor share in overall wage inequality.

Besides Minsky (1986, p. 174), Gordon (1998), and Sawyer (1985, p. 27), Cowling also recognizes that rising market concentration is associated with increasing overhead costs (namely, non-production costs, including the salaries of white-collar workers) in the UK economy since the mid-1960s (Cowling, 1982, p. 173). However, this work is also outdated.

Fernandes et al. (2014a), Murphy (2013), and Hartzell and Starks (2003) deal with the relationship between level of competition and executive pay, but not specifically with the wage differential between white-collar and blue-collar workers. Fernandes et al. (2014b) discusses skill premium and concentration. Its findings, however, stand in contradiction to the argument of this paper: "increased product market competition, which resulted from deregulation, increased the returns to a university degree and the returns to skill."

Almeida-Santos et al. (2010) deals with wage differential between white-collar and blue-collar workers, but merely in relation to training.

Palley (2006; 2015) deals with the impact of wage differential between managers and production workers on growth and on the character of the growth in question (i.e., wage-led or profit-led), but not with market concentration. Vasudevan (2015) emphasizes the role of the

managerial class in raising the mark-up rate, but not the role of white-collar workers as this paper does.

Thus, one of the original contributions of this paper is to reveal the structural relationship between market concentration and wage differential between white-collar and blue-collar workers and to test it via contemporary macro-data.

2. Understanding the wage structure via the market structure

The higher impact of *industry internal* wage inequality (by 85-90%), as compared to *cross-industry* wage inequality, on overall wage inequality in the US between 1965- 2015 (Kristal and Cohen 2016, p. 12) shows:

(i) that increased wage inequality across all sectors has been a macro issue, not a sectoral issue. Moreover, a long-lasting secular increase in wage inequality indicates a structural change in the market.

(ii) If '*the struggle about money-wages*' (Keynes 1936) within all sectors has been differentiated, then wage inequality has to cover all occupations in all sectors. Since occupations are categorized mainly as ancillary labour (white-collar work) and production labour (blue-collar work), the analysis relies on this *cross-occupational inequality*, i.e. white- and blue-collar distinction.

It is worth making clear what is exactly meant by white- and blue-collar distinction and market concentration before discussing the relationship in more detail.

My distinction between white- and blue-collar workers has nothing to do with the skill-level of workers, unlike that proposed by the SBTC approach. Rather, it is based on the tasks workers perform. The essential point is whether these tasks are ancillary, innovative tasks whose purpose is to increase the market share/market power of the firm or tasks whose purpose is simply to produce goods and services. Blue-collar workers may also be highly skilled, in order to be able to manage computers during the production process; as reported by Bisello and Fernández-Macías (2018), the use of digital tools by blue-collar workers has been increasing. Gordon lists a wide range of ancillary tasks aimed at increasing market share (Gordon, 1998, p. 327).[9] The white-collar/blue-collar distinction might appear confusing, since some jobs might correspond to white-collar jobs despite their having nothing to do with increasing market power. Nonetheless, it represents the option that can be most readily tackled by way of analysis of the available data. Calling innovative ancillary labour white-collar work and manual labour blue-collar work would not lead to crucial empirical and theoretical shortcomings, despite the existence of challenging examples such as cleaners, accountants, etc. Furthermore, even in the case of "team production" techniques (Toyota model), blue-collar workers are not particularly paid for their contributions in inventions. I do not mean that they are not capable of inventing. I emphasize the defined and categorised tasks of them. The term "wage differential" implies the increasing wage inequality between two specific groups of workers; in this case, between white-collar and blue-collar workers.

By 'market concentration' somewhere termed as *oligopolisation* or *monopolisation*, I have in mind situations at the macro level that are not fully competitive in which big firms are not price-

[9] See Blanchflower and Oswald (1990) for a similar definition and a similar distinction.

takers (Minsky, 1986, p. 181; Baran and Sweezy, 1966, p. 54)[10] and can differentiate their products in line with their market strategies, in order to be able to charge higher markups over their average costs by virtue of lowering the break-even point where total costs and total revenue are equalized. I am interested in market concentration at the macro level, not at the sectoral level, and thus prefer to measure it by the 'reverse break-even point' in the nonfinancial sector at the macro level. I prefer the term 'market concentration' instead of 'market power' since the former refers to a macro case, where the latter refers to relative market position of individual firms. Since the increase in market concentration indicates a change in market structure, its relationship with wages implies a structural causal relation. By the word *structural*, I mean to imply that the relationship is not merely temporary and contingent but has a long-lasting (and even maybe a path-creating) impact.

Market structure plays a crucial role with respect to wage structure, since the "struggle about money-wages" (Keynes, 1936) is different across different types of employees and employers and also "because the structure determines the behavior of the firms" (Sawyer, 1981, p. 147). More precisely, the greater bargaining power of workers employed by big dominant firms which can easily have their prices reflect changes in their costs, allows them to increase their money-wages more easily than weaker workers employed by SMEs, which cannot so readily adjust their prices to reflect cost changes (Allen, 1968; Kalleberg et al., 1981). Even and Macpherson (2012) confirm the wage premium paid by large firms; however, they found that it fell over the past 20 years.

For a more coherent and comprehensive explanation of rising wage inequality, it should first be clarified what type of firms pay more to what type of employees. However, economists have not paid attention to the impact of firm size on wage dispersion, because of the belief that "inter-size wage differentials are minor" (Tachibanaki 1997, p. 12). This belief might arise from the fact that they pay attention to *intra-occupational inequality* among firms (generally speaking, within blue-collar occupations and white-collar occupations, taken separately), but not to *cross-occupational inequality*.

Cross-occupational inequality has to be taken into account, due to the fact that big firms employ more and pay more on overhead and to ancillary salary earners – namely, white-collar workers (who carry out innovative tasks such as R&D, design and differentiation of products, financial/capital market operations, market research, advertising, marketing and sales operations, etc.) – as compared to manual labour (blue-collar workers) (Minsky, 1986).

Tachibanaki claims that the wage gap between white-collar and blue-collar workers is a universal fact, apart from a few exceptions (Tachibanaki, 1997, p. 2). However, there is no explanation provided for the increase in wage dispersion that has been experienced in the last three decades.

Regarding why white-collars are paid more, it has been argued that white-collar jobs require education and training to handle more complicated and difficult tasks (Tachibanaki, 1997, pp. 2-3).

However, the abovementioned non-production tasks performed by white-collar workers are not paid more just because they are complicated and difficult, but also because they function to increase or at least to preserve the market share of the firm (Kalecki, 1954; Minsky, 1986; Sawyer, 1981, 1985; Shepherd, 1997; Steindl, 1990). In the case of such tasks, whether through cost-reducing production technologies or through demand-elasticity-reducing product differentiations and advertising (Sawyer, 1981, pp. 107-111), the aim is to reduce the break-even

[10] It is worth remembering that this paper relies mainly on post-Keynesian economics such as Minsky (1986), Kalecki (1954; 1971; 1990), and Steindl (1952; 1990), rather than on a Marxist political economy.

point of the firm where costs and revenues are equalized (Steindl, 1990, pp. 305-306). Dominant firms in labour-intensive sectors, such as garment and retail industries, may prioritize innovations to make the cost curve flatter, whereas in capital-intensive sectors they may prioritize innovations to reduce the elasticity of their demand curve. For further discussion of this, see Toporowski (2005). Once the break-even point has been lowered, the firm can either charge a higher mark-up or reduce its prices to drive rivals out of the market or to prevent new entries into the market (Sylos Labini, 1962). Hence, as Steindl (1990) notes, "break-even point is a measure of the degree of monopoly' and 'the break-even point will be lower if mark-up is higher", p. 307).

In this connection, it could be argued that big dominant firms are inclined to employ and pay more to white-collar workers, in order to increase and/or maintain their dominance. Due to their stronger balance sheets – i.e., having more resources, higher levels of capital stocks, assets, profit and cash – bigger firms are more capable of doing so (Minsky, 1986, p. 181). Small firms, due to their more elastic demand curves and restrictive cost structures, cannot afford to employ and pay white-collar workers as much as big firms can. SMEs running non-production businesses (such as consulting, finance, accounting, insurance, advertising, and market research) can be regarded as derivative of the rising market concentration, since these SMEs mostly undertake outsourced tasks. The overseas outsourcing of blue-collar jobs (Roach, 2007, p. 13; Gereffi et al., 2005) is associated with the purpose of reducing the average labour cost; hence it is not independent from the rise of large multinational corporations (MNCs), i.e., market concentration. Then it is possible to infer that most of the domestic blue-collar tasks are carried out by workers employed by SMEs.

It should be noted that I do not mean just that big firms pay more in performance-evaluation-based fees, premiums, bonuses and commissions merely in return for the success of white-collar workers if they have accomplished innovative tasks and if they have increased the firm's market share. Rather, the already dominant big firms, as well as firms that endeavour to challenge the dominant firms via innovation, employ relatively more and hence pay more to white-collar workers than blue-collar workers for their market-power-increasing innovative tasks. Wright stresses that "large-scale, monopoly corporations, therefore, would be expected to have steeper income gradients within their managerial structures than would smaller, competitive enterprises" (Wright, 1979, p. 90).

Sawyer asserts that the risks and costs of innovations that are brought about by the employment of scientists and engineers favour big firms (Sawyer, 1981, p. 126) and he notes that, in the mid-1960s in the UK, the largest 100 firms accounted for 69.5% of R&D programs.[11] The United States Department of Agriculture provides more current empirical evidence, showing that market concentration in the agriculture sector has increased from 1994 to 2009 and "the largest agricultural input firms are responsible for a large and growing share of global agricultural research and development" (Fuglie et al., 2012).

Hence, R&D and the computerization of production technology, which might be conceived as a technological instrument for reducing the break-even point, have for the most part been first introduced by big firms that can afford them. Innovation does not drop from the sky by itself; rather, it is a by-product of market forces.

[11] For a discussion from a Schumpeterian viewpoint of the (inverted U-shaped) relation between level of competition and innovation or technological advances, see Tingvall (2006), Crespi and Patel (2008), and Aghion et al. (2005). Very briefly, this literature suggests that, after a certain point of market concentration, as long as they can keep their market share under the given conditions, dominant firms do not innovate, even though they can afford to do so, because of lower competitive challenges.

Elucidating the relationship between the break-even point and overhead costs (paid to white-collar workers) by way of price-output settings of firms would help us to comprehend why bigger firms pay and employ more white-collar workers and thereby how wage differentials have essentially been driven by rising market concentration.

One of the most important differences between the price-output settings of price-taking small firms and price-making big firms is that, whereas price-makers can vary their output level between a lower break-even point and an upper break-even point[12] in a wider range against deviations in demand,[13] price-takers do not have this possibility.[14] This is because price-takers "are forced to accept what they can get; they take price as a parameter and set output along their MC [marginal cost] curve" (Minsky, 1986, p. 181).

The second important difference between price-taking and price-making firms is the gap between their cost curves. Firstly, the gap between the price level and average technologically determined costs (i.e., average direct production costs, ADPC), namely mark-up (ibid., p. 173), is wider in the case of concentrated markets. Secondly, bigger firms have a wider gap between ADPC and average overhead costs (AVOV), as they employ more white-collar workers (in sales operations, advertising, marketing, design, R&D, business management, etc.) in pursuit of enhancing and preserving their market share.[15] For example, Sawyer reports that, according to the findings of Marcus, based on a sample of 78 consumer goods industries, advertising can contribute to industrial concentration (Sawyer, 1981, p. 118). Katırcıoğlu (1989) found, similarly, that advertising significantly contributed to the concentration in the Turkish manufacturing industry between 1975 and 1985.

From this it could be inferred that a higher mark-up, and a higher share of AVOV within costs, would widen the gap between the lower break-even point and the upper break-even point, since innovative tasks performed by overhead labour lower the break-even point and thereby increase the mark-up. Minsky underscores this point as follows:

> Market power, which allows a firm to constrain price movements when demand falls, may be a prerequisite for the use of expensive and highly specialized capital assets and large-scale debt financing (Minsky 1986, p. 181).

However, "price-taking firms will tend to have smaller overhead and validating costs of capital per unit of output than price-making firms" (ibid., p. 181). This is because, in order to have a buffer against falling prices, smaller competitive firms have to hold debt and overhead costs at a lower level and near to technologically determined costs. It is thus that they are able to survive if prices fall dramatically. This is confirmed by the increasing share of unit nonlabour costs within average total costs for US nonfinancial corporations, as shown in figure 2. Findings of Chang et al. (2017) that firms exhibit lower proportions of variable-to-fixed costs in the presence of higher levels of customer concentration are supportive of this statement.

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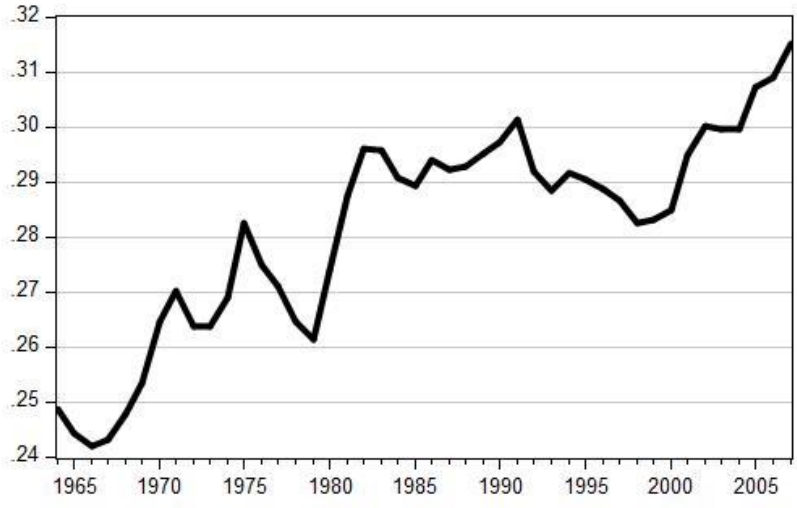
[12] Beyond the lower break-even point, revenues exceed costs; and, beyond the upper break-even point, costs again exceed revenues.

[13] Being able to vary output corresponds to big firms' ability to maintain desired excess capacity, as Steindl (1952) has pointed out.

[14] See Lee (1999) for a discussion of Post-Keynesian pricing theory. I prefer Minsky's pricing model, as he considers the role played by the financial situation (cash-flows) of firms in pricing decisions.

[15] Minsky defines this difference "as allocations of profits, a use of the surplus" (Minsky, 1986, p. 173). It is, however, debatable whether salaries of white-collar, ancillary workers should be considered as wage costs or allocation of profit. Although it falls outside the scope of this paper, I would just like to point out that, in order to be able to define salaries of ancillary labour as 'profit allocation,' they would have to be paid under the condition of profit realization. If they are paid regardless of profit realization, like wages to production labour, then they must be considered wage costs. King and Regan (1976) criticize Kalecki for treating salaries as fixed costs.

Figure 2 – *Share of unit nonlabour costs within average total costs of US nonfinancial corporates*



Source: fred.stlouisfed based on unit nonlabour cost per real gross value added (https://fred.stlouisfed.org/series/A467RD3A052NBEA) and unit labour cost (https://fred.stlouisfed.org/series/A460RD3A052NBEA), 1964-2007.

The other factor explaining why the share of white-collar workers within employment rises with market concentration is that "overhead, advertising, research and development expenditures, and staffs will be protected until output approaches and even falls below O1" (the lower break-even point) (ibid., p. 180) and "overheads cannot be cut as readily or as quickly as the direct costs of production" (Shapiro, 2005, 547). Besides the higher blue-collar unemployment rate, according to the database of the Bureau of Labour Statistics (BLS), the average displacement rate of white-collar workers between 1981 and 1998 was 2.71%, whereas for blue-collar workers it was 4.62%.16 The argument is also supported by the findings of Wright and Dwyer (2003, p. 304), which suggest that net job creation in the top-paying quintiles was not negative during the contractions of 1973-1974 and 1980-1982. It was only during the contraction of 1990-1992 that it was negative, but still less so than in the other quintiles. This means that the contraction of 1990-1992 caused big firms' output to fall under the break-even point.

Two main concerns explain the protection afforded the employment of ancillary white-collar workers: (*i*) the higher replacement costs and thus higher turnover costs of white-collar workers, which is a function of unemployment and salary levels of white-collar workers; and (*ii*) the market-share-increasing strategic role of the tasks performed by white-collars.

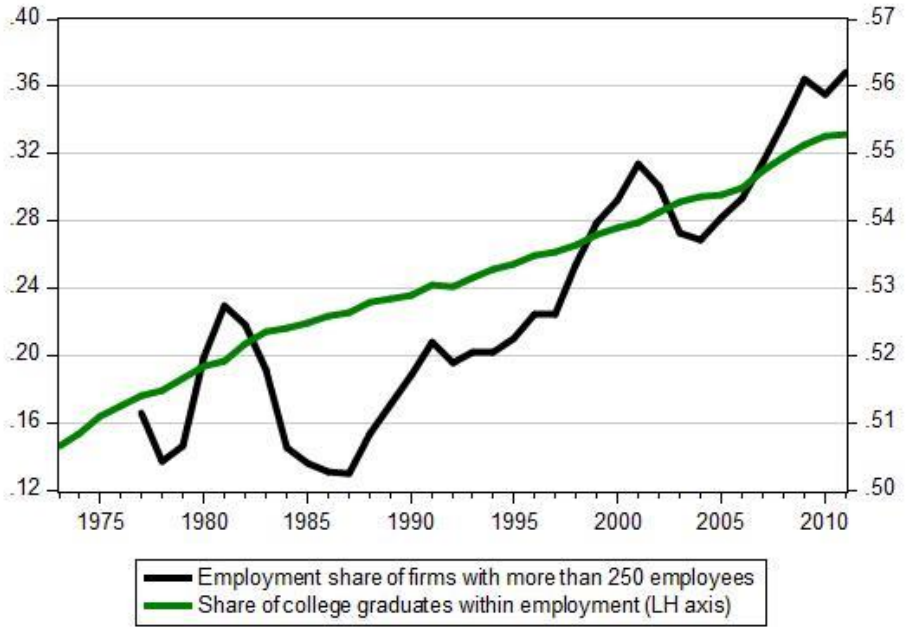
As a result, as the ratio of white-collars workers to blue-collar workers – or, in other words, the share of overhead costs within overall production costs – rises, higher markups become more applicable (Sawyer, 1985, p. 27). As Minsky puts it:

> If the ratio of overhead and ancillary wages to technologically determined wages is higher for every output, then the markup and the price of the product will be greater for every level of output than in the absence of such spending (Minsky, 1986, p. 174).

16 See http://www.bls.gov/opub/ted/2001/july/wk5/art04.txt

It should be kept in mind that the diffusion of a new innovation – either in production technologies or in advertisement, sales promotions, product differentiation, etc. – introduced by a single (big) firm depends on the employment share of white-collar workers in other firms: workers who are needed to implement and adopt or to imitate this new innovation. The higher share of white-collar workers within a sector expedites the diffusion of new innovations to other firms. This, in turn, creates a path in which market concentration and the employment of white-collar workers feed back upon themselves due to higher demand for white-collar ancillary labour which is driven by competition in innovation until a certain threshold has been reached. Beyond the threshold, which depends on market conditions and level of economic activity, the path might be broken due to unsustainability.

Figure 3 – *Share of college graduates within employment and employment share of firms with more than 250 employees*



Sources: http://www.epi.org/data/#?preset=wage-education and http://www.census.gov/ces/dataproducts/bds/data_firm.html, respectively. Data for the US, 1973-2011.

Since the market power of price-taker small firms is restricted, their ability to employ ancillary labour and the share of overhead costs in their total costs are also restricted as compared to big firms. It is possible to infer from figure 3, which portrays the increasing employment of college graduate workers (i.e., white-collars) and the rising employment share of firms with more than 250 employees, that a new labour market structure has been constituted in which demand for and supply of white-collar labour is higher than in competitive markets. Azar et al. (2018, p. 18) also found that there is a positive correlation between product market concentration (i.e., monopoly power) and labour market concentration (i.e.,

monopsony power).[17] Hence the rise in white-collar employment seems to be the product not only of exogenous SBTC but also of market concentration, since dominant firms employ "expensive and highly specialized capital assets" (Minsky, 1986, p. 181) and white-collar workers in order to enhance and preserve their market power and market share. To put it explicitly, there should be demand for white-collar ancillary labour by firms that can afford it.

In the case of a concentrated market, effective demand is structurally weakened by the increased wage differential between white- and blue-collar workers (see figure 1), as this leads to a decrease in the purchasing power of blue-collar workers and to an increase in the savings of white-collar workers (see Dögüs, 2018). Minsky states:

> The greater the ratio of wage income from ancillary and overhead services to wage income that is determined by technology, the higher the demand price per unit of output relative to technologically mandated production costs (ibid., p. 174).

From this point of view, the differentiation of the struggle about money-wages between blue-collar and white-collar workers and the causal nexus between market concentration and wage differential can be better understood through the effective demand channel and diffusion of innovations, as discussed above. If we remember that employment and thus wage growth are mainly demand driven (Keynes, 1936), then, in the case of competitive markets where small firms produce quasi-homogenous products, the job growth for blue-collar workers is higher and this supports the growth of wages of blue-collar workers. In this case, profits mainly rely on production level. On the other hand, in the case of concentrated markets, profits mainly rely on the higher mark-up charged on high-end goods produced by favourite brand-value firms and these goods are consumed mostly by higher-paid white-collar workers employed by large dominant firms, whereas lower-paid blue-collar workers' consumption of these expensive goods is more restricted. In such a case, higher mark-ups require lowering the price elasticity of demand by way of differentiation of products, advertisement and innovation; demand for those favourite brand-value products supports the growth of employment and salaries of white-collar workers more than production labour, as it does not correspond to mass production.

In other words, in the case of concentrated markets, higher mark-ups are reflected in a higher price level, as white-collar workers validate their own employment via their consumption, which has been enabled by the higher wage differential (ibid., p. 174). Findings of Dögüs (2019) show that consumption differential between white-collar and blue-collar workers validates markups. Wilmers (2017) also points out that income and consumption at the top can affect the wage distribution and that small and competitive firms are mainly both employers of relatively lower-paid (blue-collar) workers and producers of goods consumed by those workers.

Additionally, this process differentiates the bargaining positions of white-collar and blue-collar workers. The higher number of large firms and vacancies for white-collar jobs increases the outside options for white-collar workers and, as Acemoglu (1998) points out, white-collar workers have greater bargaining power than blue-collar workers because white-collar workers have more outside options. The fact that white-collar unemployment has been always lower than blue-collar unemployment[18] is another factor that confirms the relative greater bargaining power of white-collar workers.

[17] However, the impact of "monopsony power of employers" on wage inequality is out of the scope of this paper, as it focuses not on within-group inequality but on between-group inequality, i.e., between two specific groups of workers. For further discussion on monopsony power and labour market concentration, see Bivens et al. (2018), Benmelech et al. (2018), and Azar et al. (2017).

[18] http://www.stateofworkingamerica.org/charts/unemployment-job-category/

There are two main empirical findings that support the argument that the increase in market concentration at the macro level has a considerable impact on rising wage inequality. Firstly, as reported by Kristal and Cohen, about 85-90% of overall wage dispersion in the US between 1965 and 2015 was brought about by industry-internal wage dispersion. The rest (15%) can be attributed to dispersion between industries (Kristal and Cohen, 2016, p. 12). If the wage dispersion between industries had a stronger impact on overall dispersion, then it would be possible to say that (*i*) the dispersion has increased merely because of some technological, institutional or other external changes, which led only some industries to expand and thereby to be able to pay more as compared to other industries and (*ii*) that this process has not been diffused to other sectors.

In this sense, the argument that a sectoral shift (i.e., a shift from the production to the service sector) might be an explanatory factor behind wage dispersion (Heise, 1997, p. 369) appears to be unconvincing for two reasons: firstly, the labour supply would adapt to the changes in sectoral requirements in the long-run, which might reduce wage dispersion; secondly, all sectors, including the service sector, have experienced both concentration and wage differential (see figure 4).

The stronger impact of industry-internal wage dispersion on overall dispersion also confirms that all sectors have experienced the rise of big firms that can more readily afford the payment and employment of white-collar workers. This point justifies the use of market concentration at the macro level, since the concentration in question is a structural and a macro issue.

The second point is that top-end wage inequality has increased more than low-end wage inequality (Lemieux, 2008). According to my own calculations based on *The State of America*[19] dataset, whereas for male wage-earners, wage inequality between the 50th and 10th percentiles has increased in the US from 1973 to 2012 by 5.7% (for female wage earners, by 6.55%), the dispersion between the 90th and 50th percentiles of male wage-earners has widened by 32.8% (for female workers, by 28.9%). The faster increase in top-end wage inequality as a function of managerial pay schemes is also a result of an increasing number of big firms, which prioritize the employment of managerial white-collar workers and can afford it. Tosi et.al. show that "firm size accounts for more than 40% of the variance in total CEO pay" (Tosi et al., 2000, p. 329). In a report for the World Bank, Kelly et al. (2017, p. 170) show that wage inequality in Europe has been driven by firm inequality. Shin reports that "the main driver of the widening gap between executives and workers was the rise in executive compensation, rather than stagnant wages for workers" (Shin 2014, p. 29-30) and that "firms that hired external CEOs tend to have a wider wag gap" (ibid., p. 19).

To sum up, as wage inequality (i.e., paying more to employees than other firms) requires bigger firms, a structural, secular increase in wage inequality would not be possible if there were no structural, secular rise in market concentration. That is to say, without any change in market structure, which might have been underpinned by SBTC and/or institutional change, a change in wage differential would be temporary, since the workforce would adapt to the changing requirements in the medium or long run. For example, the share of low-wage workers with a high school degree increased from 48% in 1968 to 79% in 2012 (see Mishel, 2014). This shows that low-wage workers have upgraded their skills.

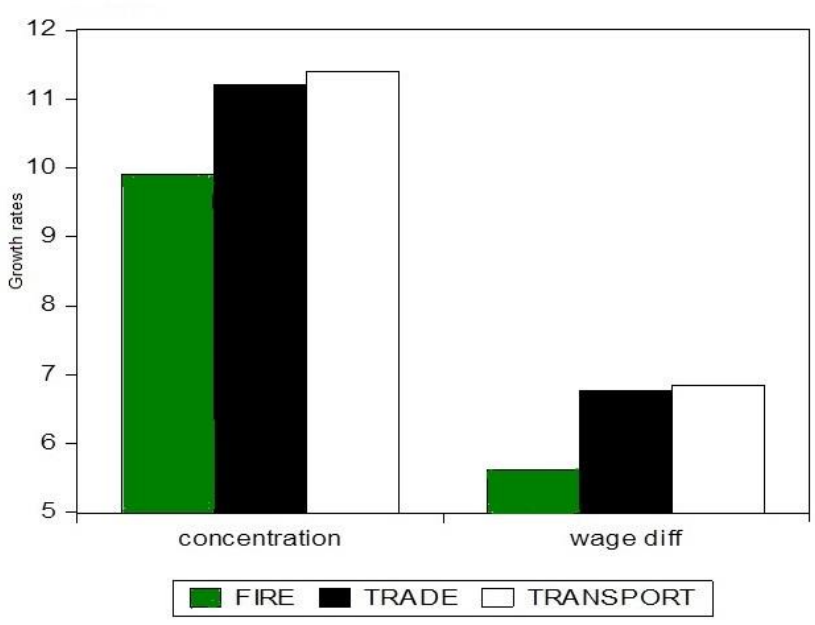
[19] http://stateofworkingamerica.org/chart/swa-wages-figure-4k-wage-inequality-men/

3. Empirical evidence

This chapter deals with empirical testing of the main argument that there is a direct relationship of structural causality between wage differential and market concentration between 1964 and 2007. The reason for using a US macro data set with a 43-year time span is to demonstrate and to capture this long-run structural tendency during the recent decades in which the dramatic changes in question have taken place.[20]

Before testing the structural relationship between a widening wage differential and market concentration at the macro level, a sectoral-level comparison would be helpful. Figure 3 depicts the co-movement of the growth rates of wage differentials and of market concentration ratios (revenue share of the 50 largest firms) from 1997 to 2012 in the trade, transportation and FIRE (finance, insurance and real estate) sectors.[21] The transportation sector has experienced the highest level of concentration and also of wage differential, whereas the FIRE sector has experienced the lowest. The relative lower increase in wage differential in the FIRE sector might be due to the huge amount of lower-paid white-collar workers in the FIRE sector relative to other sectors due to an excess supply of white-collar labour in this sector.

Figure 4 – *Growth rates of market concentration ratios and wage differentials in FIRE, trade and transportation sectors*



Notes: Concentration is calculated as revenue share of the 50 largest firms and wage differential as log wage 90/50; 1997 - 2012, US.
Sources: census.gov, and Kristal and Cohen (2016, p. 14), respectively.

[20] One might criticize the sample size as not satisfying; however, as there is only one independent variable in the model, it is satisfying, since if there are four independent variables, a sample size of at least 40 is suggested (Hanke and Wichern, 2014, p. 264). Kato et al. (2015) is one example of a VAR analysis with a very restricted number of observations.
[21] Only these three sectors were available for comparison from both sources.

3.1 Market concentration

Per Kaleckian theory (Kalecki, 1954), it is assumed that firms would be able to charge a higher markup rate per unit of production over their labour and raw material costs in line with their market power: "The increasing market concentration tends undoubtedly to raise the degree of monopoly in the long run" (Kalecki, 1990, p. 247). More concentrated markets would be characterised by higher mark-up rates (Kalecki, 2009, p. 30; cited in Rugitsky, 2013). Bain (1951) has a similar approach where he associates concentrated markets with excess profits.

From a Steindlian perspective, the second crucial feature of concentrated markets is that dominant firms have a tendency to maintain a higher (desired) level of excess capacity as a 'barrier to entry', i.e., in order to be able to prevent potential new entries into the market that could be spurred on by the higher mark-ups, and as a precautionary measure, such as to be able to maintain their market share in case of unexpected demand shocks (Steindl, 1952, p. 55). Secondly, concerning costs, Steindl states that "average cost of larger equipment with excess capacity is smaller than average cost of smaller equipment with full capacity. So that long run cost curve declines" (ibid., p. 10). To put it differently, with the increase of capital equipment size, firms might enjoy decreasing average cost due to excess capacity.

As firms try first to protect the employment of white-collar workers (Minsky, 1986, p. 180) and, by virtue of the higher displacement rate of blue-collar workers, greater excess capacity implies a higher unemployment rate of blue-collar workers, who represent the main source of ADPC. A correllation of 0.74 between excess capacity[22] and the blue-collar unemployment rate[23] in the period 1973-2011 supports this reasoning.

It can be inferred that, in the case of a more concentrated market structure, prices are higher than in a competitive case due to the higher mark-up that is made possible by the lower price elasticity of demand. A less-elastic demand curve, a flatter cost curve through labour-saving technology, and a relatively lower level of fixed costs can help to reduce the break-even point. Quantity of break-even point (q_b) is where unit mark-up (i.e., unit price (p) over unit labour cost (u)) covers fixed costs (f).

Total revenue = Total costs

$$q_b * p = f + u * q_b \tag{1a}$$

$$q_b = f/(p - u) \tag{1b}$$

In line with this theoretical reasoning based on Steindl (1990), I opt to employ the reverse of break-even point ($= 1/q_b$) in the non-financial sector.

The calculation of the market concentration (m) is as follows: The ratio of unit markup, i.e., price per unit of real gross value added of nonfinancial corporate business (p)[24] charged over the unit labour cost per real gross value added (u),[25] to the current fixed costs (consumption of fixed capital, structures, equipment, and intellectual property products (f).[26] All variables are indexed to 2012 to be consistent with the calculation of wage differential, which is also indexed to 2012. In order to avoid any confusion because of negative values, I first multiplied with (–1) and then subtracted from 1:

[22] See https://fred.stlouisfed.org/series/TCU
[23] http://www.stateofworkingamerica.org/charts/unemployment-job-category/
[24] https://fred.stlouisfed.org/series/A455RD3A052NBEA#0
[25] https://fred.stlouisfed.org/A460RD3A052NBEA
[26] https://fred.stlouisfed.org/series/BOGZ1FU116300001A

$$m = (p - u)/(f) \quad (2)$$

Unit cost of raw materials and other production related inputs are not included (and even not available) because price and costs are per gross value added in, which inputs have already been subtracted as it is a macro level measurement. As marginal costs are often not directly observable (Belleflamme and Peitz, 2010, p. 35) and, more importantly, firms mostly operate between economies of scale and diseconomies of scale where return to scale and marginal cost are constant (up to full capacity, as argued by Kalecki (1954), I prefer to measure the markup per unit price over unit labor cost of production. Inclusion of intellectual property products in the calculation is also meaningful when their strategic role concerning market power is considered as discussed above regarding brand-value and as emphasized in Orhangazi (2018) regarding trademarks, patents, copyrights, design and licenses.

An aggregate market concentration measurement has the advantage of capturing both the changing concentration within industries and the changing shares of industries within GDP (Cowling 1982, p. 161).

There are two reasons why I do not prefer an average weighted Herfindahl-Hirschman index (HHI) or the share of the n-largest firms within the sector, which is the most common measurement for concentration. is that, firstly, the available data is not provided as continuous time-series and, secondly, it is not clear how to calculate the weight of sectors relative to their shares of GDP or to their capital or employment intensity for the purpose of obtaining a proper measurement. Thirdly, and more importantly, as import firms also have a significant share in consumer goods and services, the share of n-largest US firms might not give accurate results. Finally, as pointed out by Kriesler (1987, p. 24), HHI does not consider the structure (elasticity) of demand.

3.2 Wage differential

As I am directly dealing with the differential between wages of production workers and salaries of overhead labour and I have argued that the differential is determined by the increase in aggregate market concentration, I employ the ratio of annual average hourly compensation of all employees in the NFC sector to average hourly wages of production workers in private sector to measure the aggregate wage differential at the macro level.

The wage differential (*wd*) as the ratio of the salaries of ancillary white-collar non-production workers to the wages of blue-collar production workers is calculated as follows:

$$wd = \frac{c}{b} \quad (3)$$

In the equation, *c* stands for annual average hourly compensation of all employees in the NFC sector[27] and *b* for the annual average hourly earnings paid to production and nonsupervisory workers in the private sector.[28] As the hourly compensation of all employees is provided only as indexed (2012 = 100), I indexed production wages to 2012 too. The ratio gives the reverse of the share of production workers within all earnings. I did not prefer (*c*-

[27] https://fred.stlouisfed.org/series/PRS88003103

[28] https://fred.stlouisfed.org/series/AHETPI#0. The average hourly earnings figure for production workers in the NFC sector is not available. However, I assume that it is not significantly different in the NFC sector due to the spread effect, as production labour in the total private sector corresponds to a great extent to production labour in the nonfinancial sector. Additionally, the private sector and the non-financial sector are not exclusive sectors; rather the former includes the latter.

b)/b to avoid negative values due to indexing, which might be confusing. In short, I assume that the declining share of production wages within all compensations would imply a relatively higher increasing share of white-collar workers and thus a rising wage differential.[29] One can criticize that there has been a major expansion of non-wage compensation for some groups, hence the measurement might not be consistent. However, it is a proper measurement, as white-collar workers get more non-wage compensation – such as profit-sharing payments, lump sum bonuses, stock options, paid leave and other forms of contingent compensation – than blue-collar workers (Pierce, 2001). Another critique could be that nonsupervisory employees (such as office and clerical workers, repairers, salespersons, operators, drivers, physicians, lawyers, accountants, nurses, etc.) violate the homogeneous nature of the denominator. However, the tasks carried out by these employees do not correspond to the innovative tasks which aim at increasing market share as those of white-collar workers do; rather they can be conceived as complementary to production process.

One can also criticize that not excluding the financial and service sector from the private sector can lead to some empirical shortcomings; however, I am interested in the change in wage differential and in market concentration at the macro level in the private sector and, secondly, because some ancillary labour, such as financial and service tasks of nonfinancial corporations have been outsourcing, expansion of these sectors can be conceived of to some extent as a by-product of the rise of market concentration. Thirdly, from a stock-flow consistency perspective, as it is examined at the macro level, whether market concentration has a relationship with differential between salaries of ancillary labour which is employed to increase profits and wages of production labour, higher profits in the financial sector over production labour at the macro level are also meaningful, especially when we think of financialization of large NFCs (see Davis, 2018). Fourth, once non-financial corporations pay more to white-collars, financial sector has also to raise the salaries to induce white-collar workers.

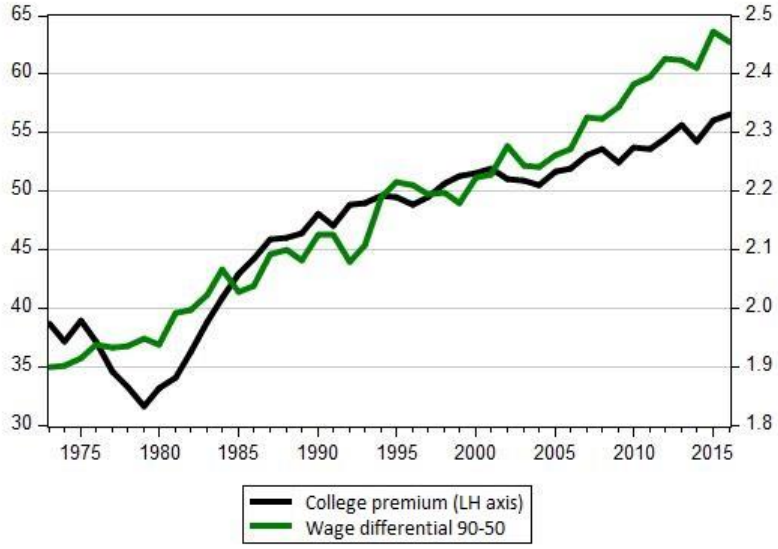
It could be argued that it would be plausible to employ top-end wage differential (see the wage differential between the 90th and 50th percentiles, as shown in figure 5) in the model to capture the wage differential between white- and blue-collar workers and its long-run structural relationship with market concentration. However, top-end wage inequality might contain the impacts of non-economic factors such as age, ethnicity, race, gender, experience, region, public sector employment, and so on. The correlation of my own calculation of wage differential (see figure 1) with the wage ratio between the 90th and 50th percentiles confirms as of 0.86 and with college premium as of 0.90 (see figure 5) that the former provides a robust measurement.

Another reasonable criticism could be that the college premium should be employed in the model instead of the wage differential between production workers and non-production ancillary labour. This might also represent an appropriate and useful tool for challenging the SBTC approach, which employs it in defence of the argument that computerization has caused wage differential to increase. Secondly, a comparison of occupation and education based on datasets of the *Consumer Expenditure Survey* suggests[30] that we can assume that non-

[29] The Bureau of Labor Statistics provides wages and salaries for white- and blue-collar workers only for the period 2001 to 2006 (CIU202G000B00000I and CIU202G000W00000I). Despite this short period, my calculation of wage differential has a 68% correlation with this dataset.
[30] Results are available upon request.

production white-collar workers consist of college-graduates and that this would not lead to any serious empirical or theoretical shortcomings.

Figure 5 – *College premium and wage inequality between the 90th and 50th percentiles*



Sources: http://www.epi.org/data/#?preset=wage-education and http://www.epi.org/data/#?subject=wagegap-coll, respectively; 1973-2016.

However, employing the college premium for wage differential might not give accurate results, due to the underemployment of college graduates (i.e., their employment in jobs that do not require college degrees, the so called "pink-collar jobs"), which has increased from 25,2% in 2000 to 28,2% in 2011, and also because wages of the 20th percentile of college graduates have experienced a decline of 4,5% in the same period, whereas the wages of the 90th percentile of college graduates increased by 2,1% (see stateofworkingamerica.org, figures 4AJ and 4AK). Thirdly, the college premium does not consider the workers who have had some years of college without completing a degree and who accounts for approximately 19% of the workforce[31]. These workers might be employed in white-collar jobs as well. Finally, since the college premium was stable during the 2000s, due to rising underemployment of college graduates, whereas wage inequality between the 90th and 50th percentiles (see figure 5) increased, the college premium seems not to be an accurate indicator for measuring wage inequality.

3.3 The model

Before running the data analysis between two variables, it is worth emphasizing that employment of white-collar workers performing innovative tasks (such as R&D,

[31] http://www.epi.org/data/#?preset=wage-education

advertisement, financial/capital market operations, market research, etc.) to reduce the break-even point in order, for example, to be able to charge a higher markup, is not the sole factor behind rising market concentration. It is rather a contributing factor, which is meant to maintain or increase the market share of the firm. As indicated by Toporowski (2016), Brennan (2016), Minsky (1986), and Blonigen and Pierce (2016), market concentration is a matter of privatizations and capital market operations, such as M&A and hostile takeovers, rather than of goods market operations.

The dominant corporations of today, such as General Electric, Tata, Boeing, or Microsoft, achieved their preeminence not through their ability to produce electrical equipment, steel, aircraft, or software better than their competitors, but by buying up those competitors in the stock market (Toporowski, 2016, p. 4).

As the main argument of the paper is that there is a structural and direct causal relationship between market concentration and wage differential, a VAR model with impulse response function and variance decomposition analysis is one of the best options for examining this issue. In the VAR model, "each endogenous variable is assumed to depend on lagged values of itself and of all other endogenous variables" (Dées and Güntner, 2016, p. 5). Such an assumption is appropriate both for market concentration and wage differential, since, as pointed out above, they feed back upon themselves. However, as this paper deals merely with the causality running from market concentration to wage differential[32] the flipside of the relationship (i.e., causality running from wage differential to concentration) is here ignored despite the fact that the VAR model assumes that the relationship is bi-directional because wage differential causes market concentration not directly by itself but rather indirectly through consumption inequality between white-collar and blue-collar workers,[33] as confirmed below by Granger-causality test results.

The impulse response function reveals whether the causality between variables is direct or not and variance decomposition analysis "provides valuable supplementary information about the interlinkages among the variables in the model" (Greenwood-Nimmo and Tarassow, 2013, p. 12). Both analyses provide structural clarification of how strong and how long-lasting the effects are. Moreover, the impulse response function has an advantage, inasmuch as it reveals that the power of the effects is not stable but rather might fluctuate and might even turn in the opposite direction (from positive to negative and vice-versa) after a certain time. A simple Ordinary Least Squares (OLS) method would present only the average coefficient across the time span which indicates the explanatory power of an independent variable (here market concentration) on the dependent variable (wage differential). Indeed, this coefficient of dependent variable might change across time and does not indicate any relationship of causality; rather it points out that they are associated. To reveal to what extent the variance of the dependent variable is explained by the independent one, showing how the former reacts

[32] I do not opt for any endogenous or exogenous control variable in the model due to the fact that what is being tested is merely whether the causality is direct or not. Secondly and more importantly, any possible relevant control variables (such as GDP, unemployment, technology, union membership, etc.) are endogenous to changes in market concentration, as mentioned above. Brüggemann (2006) and Alp and Seven (2019) are just two examples among many studies running VEC analysis without any control variables.

[33] The flipside of this relationship is that rising wage dispersion consolidates and spreads the concentration across sectors through white-collar workers' consumption of expensive high-end goods produced by other dominant firms in other sectors. See Dögüs (2019) for further discussion on the impact of rising consumption inequality between white-collar and blue-collar workers on market concentration. Alp and Seven (2019) present an example of a VEC model which reports only one direction of relationship.

to a one-unit-shock in the latter, and how they behave across time, is much more meaningful concerning their relationship of causality.34

Table 1 – *Descriptive statistics and Unit Root test results:* t-*statistic*

Descriptive statistics	**Market concentration**	**Wage differential**	**Unit root test**	**Augmented Dickey-Fuller test**
Mean	0.75	0.15	**Market concentration** *(with trend and intercept)*	-2.99 (critical value at 5%: -3.51)
Median	0.77	0.16	**Market concentration (-1)** *(with intercept)*	-5.57 (critical value at 5%: -2.93)
Maximum	0.97	0.25	**Wage differential** *(with intercept)*	-1.30 (critical value at 5%: -2.93)
Minimum	0.48	0.06	**Wage differential (-1)** *(with intercept)*	-4.68 (critical value at 5%: -2.93)
Standard Deviation	0.11	0.05	**Residuals** *(with intercept)*	-4.05 (critical value at 5%: -2.93)
Skewness	-0.28	-0.12	**Johansen cointegration test results**	Trace statistic: 17.22 (critical value at 5%: 15.49)

Note: Both variables are I(1) and the residuals are I(0) at 0.05 level.

As the variables have non-stationarity and co-integration (see table 1), since residuals of a simple OLS are *I*(0) (Brooks, 2008, p. 340; Hjalmarsson and Österholm, 2007, p. 4), and as the Johansen cointegration test indicates the existence of cointegration with 1-period lag, I employ a Vector Error Correction (VEC) model because cointegration methodology is appropriate in order to test whether there is a long-run relationship between the variables in question (Engle and Granger, 1987). A VEC model is advantageous since, if no long-run cointegration test has been performed, the empirical studies cannot be regarded as fallibilistic, positivist tests (Heise, 2019, p. 8). The Akaike-Information Criterion test is preferred as it is superior for small samples (Liew, 2004, p. 2) and its results suggest a 2-period lag length (see Table 2). However, a VEC model is preferred to be run with one lag less than suggested for the VAR, as proposed by Sharp (2010, p. 35).

34 Tarassow describes what is being analysed by way of the impulse response function and variance decomposition as follows: "[...] impulse-response function which computes the propagation over time of a shock on the variable of interest. The variance decomposition analyzes the relative impact of a shock in one variable on the total variance of the variable of interest – it measures the relative impact of a structural shock for the explanation of the total variance of the dependent variable" (Tarassow 2010, pp. 14-15).

Table 2 – *VAR lag order selection criterion*

Lag	Akaike-Information Criterion
Lag 0	-5.16
Lag 1	-9.68
Lag 2	-9.72*
Lag 3	-9.57

In line with the theoretical framework outlined above, that market concentration (m) leads first to wage differential (wd), the VEC model equation has the following form:

$$\Delta wd = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, \Delta wd_{t-i} + \sum_{i=1}^{n} \beta_{2i}\, \Delta m_{t-i} + \beta_3 EC_{t-1} + \varepsilon_t \quad (3)$$

$$EC_{t-1} = wd - a - \beta_4 m_{t-1} \quad (4)$$

β_{2i} is the short-run coefficient and shows the effect of independent variables on the dependent variable. Coefficient β_{3i} is the error-correction coefficient which is tested by analysing whether it is significantly different from zero and shows the long-run causality. β_{4i} is the long-run coefficient that shows the effect of the independent variables on the dependent one (Deleidi, 2018, p. 195).

3.4 Results

The t-statistic of the coefficient of error-correction term ($\beta_3 = -0.13$) which refers to the existence of long-run causality and the t-statistic of long-run coefficient ($\beta_4 = -0.74$) in the VEC model (see table 3) are significant at the 95% level, as t-statistics are greater than 2.00 and indicate that there is a long-run positive relationship from market concentration to wage differential. The coefficient of error correction term of -0.13 indicates that the deviation from the long-run equilibrium in wage differential is adjusted by 13% by the following period. The short-run ($\beta_2 = -0.10$) negative impact of market concentration from one year ago on wage differential can be explained by way of positive impact of extra profits on real investment which underpins wages of production labour and thus reduces the wage differential.

Table 3 – V*EC*(*1*) *estimation output*

	Coint.Eq. 1
Wage differential (-1)	1.000
Market concentration (-1)	-0.74
	(-9.44)
C	-0.34
Error Correction:	***D*(Wage differential)**
Coint. Eq. 1	-0.13
	(-2.97)
D (Wage differential (-1))	0.21
	(1.45)
D (Market concentration(-1))	-0.10
	(-2.31)
C	0.005
	(2.96)
R-squared	0.25

Note: t-statistics are in parenthesis.

Figure 6 – *Accumulated impulse responses of wage differential to one-unit shock in market concentration for the period 1964-2007*

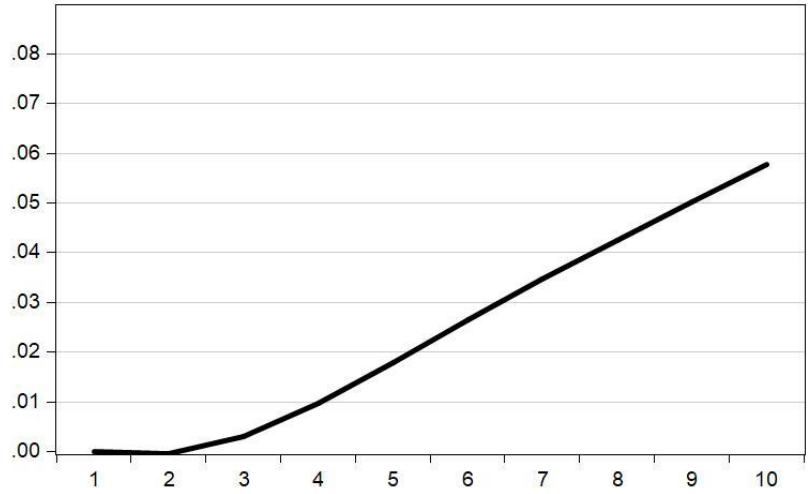
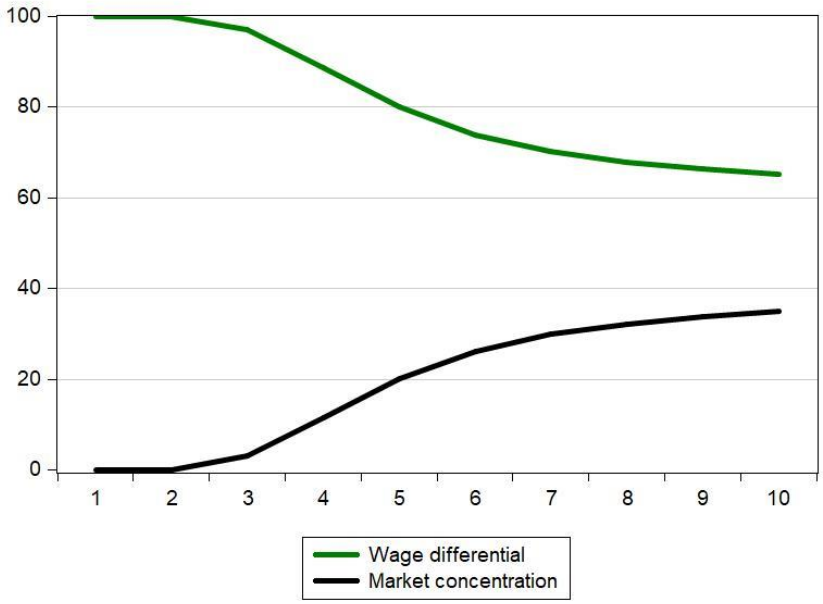


Figure 7 – *Variance decomposition analysis of wage differential due to market concentration for the period 1964-2007*



As seen in figure 6, the responses of wage differential to a one-unit shock in market concentration are positive and rising in the third and fourth periods.

As shown by figure 7, up to 35% of the variations in wage differential in the long run are due to market concentration. This result does not falsify and in fact strongly supports the main

argument of this paper, that market concentration has a direct and positive causal effect on wage differential between white-collars and blue-collars, since big firms in more highly concentrated markets, or firms endeavouring to increase their market share, can employ and pay more to white-collar workers, in order to preserve or increase their market shares thanks to innovative tasks performed by white-collar workers.

As seen in figures 6 and 7, the impact of market concentration starts to rise obviously after the third period. It might be associated with the fact that once market concentration has been consolidated, big firms' appetite for real investment diminishes (Steindl, 1952) and they become more interested in operations to increase and preserve their market power; hence competition in innovation prevails, which increases the demand for white-collar labour more than for blue-collar labour, and product competition increases overheads of firms (Shapiro 2005, p. 547).

Table 4 – V*EC Granger causality/block exogeneity tests and – EC residual serial correlation LM and normality test results*

– Ho	**Chi²**	**df.**	**Prob.**	**EC (1) 1964-2017**	**Residual serial correlation LM test: LRE-statistic**	**Jarque-Bera residual normality joint test**
Change in market concentration does not Granger-cause change in wage differential	5.37	1	0.02	0.17	0.23 (0.99)	7.50 (0.11)
Change in wage differential does not Granger-cause change in market concentration	0.14	1	0.70	0.58		

Note: p-values are in parentheses.

The significance of results is supported by Granger causality (Granger, 1969) test results. As the probability value of the Granger-causality test on VEC (0.02) is less than 5 percent, we can refuse the hypothesis that market concentration does not Granger-cause wage differential (see table 4) and we can conclude that results of VEC analysis are significant at least at the 95 percent confidence level. The abovementioned assumption that wage differential causes market concentration not directly but rather through consumption inequality between white-collar and blue-collar workers is confirmed, as we cannot reject the hypothesis that wage differential does not Granger-cause change in market concentration since its probability value (0.70) is greater than 5 percent.

Besides the Granger-causality test, robustness of results is confirmed also by VEC residual serial correlation LM and normality tests; as *p*-values for the first lag are greater than 0.05 (see table 4), we cannot reject the hypothesis that there is no serial correlation at 1 lag.

It is worth noting that alternative VEC models for the period between 1964 and 2017 do not indicate a significant causality, as in this case the probability values of Granger-causality tests are greater than 5% with different lag lengths (for example, 0.17 in VEC(1)) and hence

we cannot reject the hypothesis that market concentration does not Granger-cause wage differential. It becomes meaningful if we remember that after the financial crash in 2007 lots of white-collar workers in the financial sector lost their jobs and unemployment among them dramatically increased and thus wage differential did not rise, as seen in figure 1, despite the consequent increase in market concentration (as depicted by figure 1, from 2009 to 2013) due to bankruptcies (see Brancaccio et al., 2018). Hence after the financial crash in 2007, there was a disconnect between market concentration and wage differential between white-collar and blue-collar workers since in such a case the abovementioned effective demand channel does not work. Greenfield (2016) reported that "the yearly ritual of doling out incremental and somewhat disappointing salary increases is quietly disappearing."

4. Conclusions

Based on a post-Keynesian approach, especially Minsky's understanding of the output-price setting of firms, this paper has argued that there is a direct and structural long-run relationship at the macro level from market concentration to wage differential between white-collar and blue-collar workers since white-collar workers' innovative tasks work to increase the firm's market share. The rising share of higher-income-earner white-collars within the employment composition makes the demand curve more inelastic through product differentiation, advertisement, brand-value, and market research and the cost curve flatter via their labour-saving technological tasks and thereby reduces the firm's break-even point and hence enables it to charge a higher mark-up. In such a concentrated market case where diffusion of innovations due to competition in innovation is being expedited by white-collar workers, big firms can extract monopoly rents via competitive advantages enabled by innovations carried out by white-collar workers; thus, the growth of salaries of white-collar workers is higher than the growth of wages of blue-collar workers as white-collar workers validate their employment by way of their consumption.

VEC model analysis results based on US data between 1964 and 2007 show that the hypothesis which has been hitherto absent from the literature, that the relationship is structural causality, has not been falsified, at least at the 95% confidence level. Up to 35% of the variations in wage differential in the long run are explained by market concentration at the macro level.

The paper has made some innovative contributions to the literature by incorporating market structure and wage structure in a dynamic empirical analysis of the contemporary macro dataset. It differentiates itself by considering market concentration as a macro issue, rather than a sectoral or micro issue. It has firstly revealed the relationship between market concentration, on the one hand, and wage differential between white-collar and blue-collar workers, on the other. Furthermore, it is the first time that a measurement for market concentration at the macro level (as the reverse of the break-even point) and the wage differential between ancillary labour and production labour have been calculated.

It could be inferred that, if the employment share and salaries of white-collar workers had not increased due to concentration, then the concentration would not be structural and long-lasting. Rather, it would be temporary, since higher concentration strengthens its relationship with wage differential by way of effective demand channel and diffusion of innovations.

Since the rising dispersion between white-collar and blue-collar workers corresponds to one of destabilising inequalities, redistributive macroeconomic policies to lessen the market concentration which increases inequality are required for a stable economy.

An analysis of the relative impacts of market concentration, technological improvements, international trade and institutional changes on wage differential calls for further research.

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