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# Discussion of “The ‘Matthew effect’ and market concentration: Search complementarities and monopsony power” by Fernández-Villaverde, Mandelman, Yu and Zanetti

Michael Peters

*Yale University and NBER, United States*

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## 1. Overview

The last decades have seen a significant increase in the concentration of economic activity. Firms are getting bigger and the top firms account for a larger and larger share of employment and sales. Two salient features of this trend are depicted in Fig. 1. The left panel shows the time series of average employment. In 1980, the average firm in the US had around 20 employees. 35 years later, average employment was 24, that is 20% larger. The right panel shows that this increase was by no means due to a common increase in employment across the entire firm size distribution. Rather, the employment share of “mega” firms with more than 10,000 employees rose and the one of small firms with less than 100 employees declined. Hence, the corporate sector underwent a period of concentration where the big became bigger and the small faltered in importance.

The paper *The ‘Matthew effect’ and market concentration: Search complementarities and monopsony Power* provides a novel and intriguing take on these patterns. It starts from the premise that production is subject to search frictions. Producing firms need to find retailers to sell their goods to consumers. Similarly, retailers need to find producers to actually have something to sell. Crucially, both producers and retailers can decide on their search effort and search more intensely if the return of doing so is large.

The paper shows that such a model has three important implications for the extent of concentration that emerges in equilibrium. First, search gives rise to complementarities, which act as an amplifying force of innate productivity differences. Hence, search can cause concentration. Second, changes in the search technology can make such amplifying forces more potent and thus give rise to increases in concentration (as depicted in Fig. 1). Third, such search complementarities interact in an interesting way with other market frictions. In particular, if firms have monopsony power, such market power emerges as an additional amplifying force.

*E-mail address:* m.peters@yale.edu

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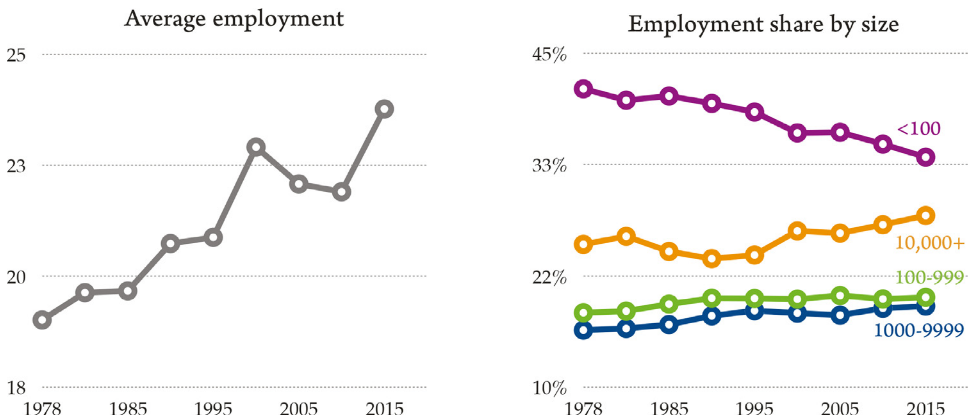


**Fig. 1.** Changes in size and concentration in the US. *Notes:* The figure show the evolution of average firm size as measured by employment (left panel) and the employment share of firms of different size (right panel) for the population of US firm. The data stems from the Business Dynamics Statistics (BDS). The figure is taken from Peters and Walsh (2020).

In my comments, I will first briefly describe the main theoretical insight in a barebones version of the model. While this abstracts from many interesting subtleties of the authors' analysis, it highlights the exact nature of the "Matthew effect" (that is why small productivity differences across firms get amplified) and why the link between improvements in the search technology and concentration is slightly more intricate then meets the eye. On this backdrop, I will then provide a more detailed discussion why this paper adds a novel and valuable perspective to the large and growing literature on the rise of concentration.

## 2. Search complementarities and market concentration: the main insight

The model in the original paper is quite rich and multilayered. It has an island structure of differentiated labor and product markets, a dynamic micro-foundation of labor market power and a process of entry and exit. While helpful for a quantitative assessment, many of these ingredients can be dispensed with in order to highlight the main theoretical insights.

### 2.1. The Matthew effect

Consider an economy with a set of final good firms indexed by $j$. Such firms have access to a technology where they can produce a continuum of goods with productivity $x_j \sim F(x_j)$. Each good has a price of unity.

To sell their goods, firms need to meet retailers that in turn are connected to customers. If retailers send a mass of $n$ sales agents to meet firm $j$, and firm $j$ searches with intensity $\sigma$, the mass of matches, i.e. the mass of goods that can be sold, is given by $M = \sigma n^{\alpha}$, where $\alpha < 1$. Search activities are costly. In particular, firm $j$ incurs a convex search cost of $A\sigma^{\zeta}$ to search with intensity $\sigma$, where $\zeta > 1/(1-\alpha) > 1$.[1] Similarly, each sales agent has a cost $\kappa$. Finally, suppose that the final good firm and the retailer split the surplus of each match according to an exogenous sharing rule $\beta$ and $1-\beta$.

Given this setup, firm $j$'s optimal search effort maximizes the firm's profits $\pi_j = \beta x_j \sigma n^{\alpha} - A\sigma^{\zeta}$. Similarly, the number of sales agents sent out by retailers (who take $n$ as given) is given by a free entry type condition

$$\kappa = (1-\beta)x_j \frac{M(\sigma, n)}{n} = (1-\beta)x_j \frac{\sigma}{n^{1-\alpha}},$$

as $M/n$ is the probability of each sales agent to be matched to a product if $M$ matches are created. The profit maximizing search effort $\sigma(n, x)$ and the optimal number of sales agents $n(\sigma, x)$ are thus given by

$$\sigma(n, x_j) = \left(\frac{\beta}{A\zeta} x_j n^{\alpha}\right)^{\frac{1}{\zeta-1}} \text{ and } n(\sigma, x_j) = \left(\frac{(1-\beta)}{\kappa} x_j \sigma\right)^{\frac{1}{1-\alpha}}. \tag{1}$$

These two best response functions illustrate the presence of search complementarities. Because $\sigma(n, x)$ is increasing in $n$, firms search more intensely if they expect to interact with a larger army of sales agents. Similarly, if retailers expect final good firms to search more intensely, they send more sales agents as the returns of doing so are higher.

The expressions in Eq. (1) also highlight the amplifying force of firm-productivity $x_j$. Because the surplus of each successful match is increasing in $x_j$, more productive firms search more. In addition, retailers send more sales agents to meet

[1] The restriction that $\zeta(1-\alpha) > 1$ is sufficient to ensure that the equilibrium is unique.

such firms, which in turn induces these firms to search even more. It is this complementarity that acts as an amplification force for innate productivity differences $F(x_j)$. In particular, equilibrium sales of firm $j$, $y(x_j)$, are given by

$$y(x_j) = \phi(A, \kappa, \beta) \times x_j^{\gamma(\zeta,\alpha)} \quad \text{where} \quad \gamma(\zeta, \alpha) = \frac{\zeta}{(1-\alpha)(\zeta-1)-\alpha}, \tag{2}$$

where $\phi(A, \kappa, \beta)$ is a constant, which is decreasing in $A$ and $\kappa$.[2]

Eq. (2) concisely summarizes the first key insight of this paper: search complementarities are a source of concentration. In particular, the elasticity of sales to firm productivity, $\gamma(\zeta, \alpha)$, satisfies

$$\gamma(\zeta, \alpha) > 1 \quad \text{and} \quad \frac{\partial}{\partial \zeta}\gamma(\zeta, \alpha) < 0 \quad \text{and} \quad \frac{\partial}{\partial \alpha}\gamma(\zeta, \alpha) > 0.$$

Hence, the elasticity exceeds unity, which is the elasticity of $y$ with respect to $x$ holding search efforts $\sigma$ and $n$ constant. Moreover, a lower convexity of the search cost function, $\zeta$, and a higher elasticity of total matches with respect sales agents, $\alpha$, increases the potency of this amplifying force. In the terminology of the authors, endogenous search is at the heart of the Matthew effect: "*for whoever has will be given more*".

Eq. (2) also highlights some additional implications that receive less (and in my opinion too little) attention in the paper. The first is purely expositional but - in my opinion - a strength of the model: the endogenous sales function has exactly the same functional form as the canonical Lucas (1978) model. Hence, directed search, in particular the elasticity of the matching technology and the convexity of the search costs, emerge as the key determinants of the span-of-control parameter $\gamma$. Moreover, the economic mechanism of this micro-foundation is compelling: because firm productivity $x_j$ is non-rival across goods, the technology to amass customers for such goods is the key reason why firms are limited in how many goods they can actually sell.

Second, (2) makes precise predictions how "the" search technology affects firm size and concentration. The emphasis on "the" highlights that changes in the levels of search efficiency (i.e. $A$ and $\kappa$) and changes in the curvature (i.e. $\zeta$ and $\alpha$) are *qualitatively* different. $A$ and $\kappa$ are neutral across firms, i.e. average size increases for every firm but the degree of concentration is unaffected. By contrast, $\zeta$ and $\alpha$ are biased towards productive firms and hence increase concentration. The analogy with Lucas (1978) is again useful: an increase in the span-of-control allows productive firms to expand relative to small firms. More formally, output is supermodular in $A$ (or $\kappa$) and $x_j$ but *log*-supermodular in $1/\zeta$ (or $\alpha$) and $x_j$.

This difference is important to evaluate the paper's claim that *"a fall in the costs of signing vendor contracts"* due to *"improvements in IT technology"* might possibly be at the heart of the rise in concentration. If one thinks of IT technology to affect $\alpha$ and $\zeta$, this is indeed the case. If, by contrast, IT technology is thought to operate on $A$ or $\kappa$, it benefits all firms equally and concentration is unaffected. In terms of Fig. 1, changes in $A$ or $\kappa$ can explain the left panel but not the right. By contrast, changes in $\zeta$ or $\alpha$ can in principle rationalize both trends.

In the paper, the authors operationalize falling search costs as a change in $\kappa$. For such a change to affect concentration, the paper introduces an additional mechanism, namely a process of entry and exit. While this process seems natural to me, I think the paper could have benefitted from a more focused discussion on what changes in IT technology actually do for the process of search and why a change in $\kappa$ is the most natural modeling strategy. Just in terms of theoretical parsimony, would a reduction in $\zeta$ have done the trick to link improvements in IT to changes in concentration?

### *2.2. Monopsony power*

As highlighted above, the paper enriches this basic framework in a variety of ways. One ingredient that deserves special attention (it is in the title after all!) is the possibility of monopsony power. To incorporate monopsony power in the simple framework above (in an admittedly reduced form way), suppose the firm's surplus share is a function of productivity, i.e. $\beta(x_j)$. The case of $\beta'(x_j) > 0$ is the case of "labor market power" because more productive (and hence larger) firms receive a higher share of the surplus. The paper shows that this is indeed the equilibrium outcome of a micro-founded model of search, where firms have labor market power as in Jarosch et al. (2019).

The way how labor market power affects concentration is interesting and (I think) surprising. In particular, it is easy to show that the elasticity of sales with respect to productivity is given by

$$\frac{\partial \ln y_j}{\partial \ln x_j} = \underbrace{\gamma}_{\text{Matthew effect}} + \underbrace{\gamma\left(\frac{1}{\zeta} - \alpha\frac{\beta(x_j)}{1-\beta(x_j)}\right)\varepsilon_\beta}_{\text{Monoposony power}},$$

where $\varepsilon_\beta > 0$ is the elasticity of $\beta$ with respect to productivity. Hence, as long as $\frac{1}{\zeta} - \alpha\frac{\beta(x_j)}{1-\beta(x_j)} > 0$, monopsony power acts as a further amplifier of innate productivity differences and is itself a cause of concentration. Crucially, monopsony power

[2] This constant is given by $\phi(A, \kappa, \beta) = \left(\left(\frac{\beta}{A\zeta}\right)\left(\frac{1-\beta}{\kappa}\right)^{\zeta\alpha}\right)^{\frac{1}{(1-\alpha)(\zeta-1)-\alpha}}$

increases both relative size and the profit share (or the mark-down) of large firms. Note that this is exactly the *opposite* of what one would expect in a setting where firms face upward sloping supply curves because firms have to restrict the quantity to reduce the price they can pay. Similarly, in the plain-vanilla Lucas (1978) model, an increase in the span-of-control parameter would *increase* concentration but *reduce* the entrepreneurial profit share (which is given by $1-\gamma$). This paper's micro-foundation of the span of control therefore adds a novel insight: changes in firm size and equilibrium mark-downs can positively co-move.

## 3. Concluding remarks and next steps

The patterns displayed in Fig. 1 are striking. Hence, it does not come as a surprise that the literature trying to explain these facts is large and growing.[3] Without doing justice to the many existing contributions, let me try to highlight why the current paper provides a (to best of my knowledge) novel mechanism.

Broadly speaking, the existing literature focuses on three explanations: changes in technology, changes in the nature of the growth process and changes in demographics. Ridder (2019) and Aghion et al. (2019) are examples of the technology-based explanation. Like the current paper, they highlight the importance of changes in IT technology. However, they argue that improvements in IT allowed firms to reduce their marginal costs of production in lieu of higher fixed costs (Ridder, 2019) and that they made it easier for firms to be active in multiple product markets (Aghion et al., 2019). Within the context of a Klette and Kortum (2004)-style model of growth, such changes increase concentration by changing firms' incentives to expand. By construing IT as a determinant of the meeting technology, this paper offers a new perspective on which aspects of firms' technology can be affected through IT. Confronting such implications more directly with micro-data on IT investments seems to be of first-order importance to start distinguishing such explanations.

Another strand of the literature argues that the increase in economic concentration is a byproduct of a fundamental transformation of the growth process of the US economy. A particular focus of that literature is that the efficiency of technology adoption by new firms and market laggards might have declined - see for example Akcigit and Ates (2019) or Olmstead-Rumsey (2020). The current paper's take on the concentration debate is decidedly more neoclassical in the sense that firms' production technologies are exogenous. However, the dynamic version of the model features endogenous entry and exit and has distinct implications, which could be tested more directly.

Finally, a recent literature links the rise in concentration to the sharp decline in population growth the US economy has experienced since the 1980s. Karahan et al. (2019) and Hopenhayn et al. (2018) are examples of neoclassical models with endogenous entry. Peters and Walsh (2020) study a model where both entry and incumbent expansion are endogenous and show that the observed decline in population growth goes a long way to quantitatively account for the patterns in Fig. 1. Distinguishing the quantitative impact of these demographic trends from the one of technological change is still a relatively under-explored aspect of this debate.

Summing up, I expect the current paper to establish itself as one important piece for the puzzle of deciphering the rise in concentration and the decline in dynamism. With its emphasis on search frictions and the resulting "Matthew Effect" it puts up a new lamppost and highlights an economic mechanism that was entirely unexplored in the context of the concentration debate. To what extent this mechanism is quantitatively important at a macroeconomic scale will - hopefully - be the subject of further empirical work in the years to come.

## References

Aghion, P., Bergeaud, A., Boppart, T., Klenow, P.J., Li, H., 2019. A theory of falling growth and rising rents. Working Paper.
Akcigit, U., Ates, S.T., 2019. What happened to us business dynamism? Working Paper.
Akcigit, U., Ates, S.T., 2021. Ten facts on declining business dynamism and lessons from endogenous growth theory. Am. Econ. J. 13 (1), 257–298.
Haltiwanger, J., Decker, R., Jarmin, R., 2015. Top ten signs of declining business dynamism and entrepreneurship in the us. Working Paper.
Hopenhayn, H., Neira, J., Singhania, R., 2018. From population growth to firm demographics: implications for concentration, entrepreneurship and the labor share. Working Paper.
Jarosch, G., Nimczik, J.S., Sorkin, I., 2019. Granular search, market structure, and wages. Working Paper.
Karahan, F., Pugsley, B., Şahin, A., 2019. Demographic origins of the startup deficit. Working Paper.
Klette, T.J., Kortum, S., 2004. Innovating firms and aggregate innovation. J. Polit. Econ. 112 (5), 986–1018.
Lucas, R.E., 1978. On the size distribution of business firms. Bell J. Econ. 9 (2), 508–523.
Olmstead-Rumsey, J., 2020. Market concentration and the productivity slowdown. Working Paper.
Peters, M., Walsh, C., 2020. Population growth and firm dynamics. Working Paper.
DeRidder, M., 2019. Market power and innovation in the intangible economy. Working Paper.

[3] For an overview of the empirical patterns, see, for example, Haltiwanger et al. (2015) or Akcigit and Ates (2021).