CESifo WORKING PAPERS

9311
2021

September 2021

Contact-Intensity, Collapsing Entertainment Sector and Wage Inequality: A Finite Change Model of Covid-19 Impact

Sugata Marjit, Gouranga G. Das

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
· from the CESifo website: https://www.cesifo.org/en/wp

CESifo *Working Paper No. 9311*

Contact-Intensity, Collapsing Entertainment Sector and Wage Inequality: A Finite Change Model of Covid-19 Impact

Abstract

In a general equilibrium model with online, entertainment and informal sectors employing skill, unskilled, and capital, we show that Covid-19 could cause polarization pushing contact-intensive entertainment industry on the brink of collapse while other two survive. Dual roles of factor-intensity and contact-intensity contribute to such finite changes, triggering inter-skill wage inequality.

JEL-Codes: D500, I180, J310, L800, N300, O100.

Keywords: wage-gap, Covid, contact-intensive, general equilibrium.

Sugata Marjit
Indian Institute of Foreign Trade
Kolkata / India
marjit@gmail.com

*Gouranga G. Das**
Hanyang University, ERICA Campus
Ansan / South Korea
dasgouranga@gmail.com

*corresponding author

"Life is a shipwreck, but we must not forget to sing in the lifeboats"—Voltaire

1. Introduction

The pandemic has jolted the world economy severely, with disruptions on the demand and the supply side, affecting overall economic performance. Lockdowns, spatial distancing, and adopting health standards are imperative with more or less similar policy regulation in practice. Some sectors face threat owing to 'consumer wariness' (risk of infection) where contact-intensity (CI) of final demand is high like in airports, cinema, opera, entertainment, and malls. CI of services differs across groups with high CI of final demand in trade, tourism, etc. On the contrary, manufacturing has low CI of final demand (6%). Constructing 'proximity intensity index' and 'occupational CI index', Famiglietti et al. (2020) has shown for USA that *non-essential CI-industries*, i.e., opera and entertainment have suffered most from job losses suffering from decline in activities. Entertainment sector has high CI, while manufacturing has much less CI, and online sector has least CI. Based on this background, we focus on the entertainment sector facing 'shutdown due to Covid-19. In particular, here a general equilibrium (GE) three-sector-four-factor mixed quasi-specific-factor model analyses when the opera sector will cease to exist while online and other casual sector survive. The most crucial aspect is the downward mobility of skilled workers and upward rigidity of the unskilled workers.

Glocker and Piribauer (2021) is a valuable study to estimate output losses in 130 nations due to contact-intensity of services and spatial distancing. The demand side impacts are felt more in the services and cultural sectors facing vulnerability. Empirical studies have documented factors, such as institutions, 'teamwork' or 'customer-proximity' underlying heterogeneous paralyzing effects of business closures--see, Koren and Peto 2021, Karabulut et al. 2021, Buesa et al. 2021, Baqaee and Farhi 2021. Uncertainty of contagion, possibilities of close contact among customers, firms or service providers, and apprehension of widespread health-fallout create 'reallocation shock' (Crane et al. 2020). Therefore, apart from *factor-intensity* of production "*contact-intensity (CI)*" of sectors matters. Barrero et al. (2021) shows negative employment growth and contraction in leisure, hospitality, other services and retail trade. For India, contact-intensive tourism, aviation, hospitality, trade, hotels, transport, communication and services contracted by 31.5% in 2020-21.[2] Other issues are impact on inequality, job losses of low wage workers and wage-cuts of high-wage workers due to 'dampened economic activity', 'decreased production', CI of 'non-essential' sectors (Grigsby et al. 2021).

Our value-addition lies in offering a GE model capturing these stylized facts. The analysis shows that voluntary distancing and contact-intensity of final demand pushes contours of contact-intensive performance sector (CIPS) bringing it on the verge of collapse. Section 2 presents the model, results and discussions. Section 3 concludes.

2. Formal Treatment: Theory

2.1 Rudimentary model

Following notations are used:

X: Skilled online sector

Y: Skilled entertainment sector

Z: informal sector.

P_j: exogenous prices for j^{th} good, $\forall j \in \{X, Y, Z\}$

[2] https://www.business-standard.com/article/printer-friendly-version?article_id=121012901523_1

W: Unskilled wage

W_X, W_Y: Wages in X, and Y-sector. Assume originally, $W_x > W$, $W_Y > W$.[3]

r: Return to K.

$a_i^j = i^{th}$ input per unit of j^{th} output, i =L, S_X, S_Y, K.

$\theta_{ij} = p_i a_i^j / P_j$ is cost-share of i^{th} input in j, p_i is price of i^{th} input;

$\overline{K}, \overline{S_X}, \overline{S_Y}, \overline{L},$: Factor endowments. "$\wedge$" = proportional changes for variable, *V*, $\hat{V} = \frac{dV}{V}$.

There are three sectors: online (X), entertainment (Y), and a casual sector (Z). Different sectors employ workers with diverse skills. For example, the entertainment sector needs specific skills (opera singer, ballet dancer, or a theater personality needs skills which is not necessary to run an online trade requiring software expertise). X uses specific skill (S_x) while Y needs performing arts skills (S_y). Informal Z-sector uses unskilled (L). 'K' is homogeneous, mobile, across X, Y, and Z. S_x, S_y, and L are specific factors. Assume perfect competition, Constant-Returns-to-Scale and Diminishing returns (DMR). Thus:

$$X = X(S_X, K)$$
$$Y = Y(S_Y, K)$$
$$Z = Z(L, K)$$

Full employment ensures:

$$a_{SX} X = \overline{S_X} \quad (1)$$
$$a_{SY} Y = \overline{S_Y} \quad (2)$$
$$a_{LZ} Z = \overline{L} \quad (3)$$
$$a_{KX}.X + a_{KY}.Y + a_{KZ}.Z = \overline{K} \quad (4)$$

From (4), $K_X + K_Y + K_Z = \overline{K}$ (4a)

Competitive equilibrium implies:

$$W_X a_{SX} + r a_{KX} = P_X \quad (5)$$
$$W_Y a_{SY} + r a_{KY} = P_Y \quad (6)$$
$$W a_{LZ} + r a_{KZ} = P_Z \quad (7)$$

Given P_j, 7 equations determine 7 variables, viz., W_x, W_y, W, r; X, Y, Z. That completes the general equilibrium. X is numeraire, $P_X = 1$. Given S_x *and* S_y, if K_z rises (or falls), K_x+K_Y falls (or, rises) and vice versa.

This is the basic model with *two* solutions. *Firstly*, it *is a 3*-sector-4-factor specific factor (SF) model based on Jones (1971), Ruffin and Jones (1977) and its variants such as, Jones and Marjit 2009, Marjit 1990, Das, et al. 2020, Marjit, et al. (2021). The conventional solution is from

[3] Nature of skills differs across sectors. Generally, skilled attracts higher wage than the unskilled ones due to higher productivity.

standard SF solving wages where W_x, W_y are greater than W. Performing artists can't become programmers and vice versa, while the unskilled can't become artist or programmers overnight. [4] Skill-unskilled wage differentials reflect differences in marginal productivities (MP).

Secondly, as mentioned before, we assume that there is *rigid upward immobility* of the unskilled casual workers to X and Y, while at the same time there is *downward mobility* of the skilled types to Z. This is the novel feature in this model where the *quasi-specific* types move. As Covid-19 shock disrupts a sector, economic rents tend to disappear due to permanent changes in commodity prices (Ruffin 1981 & 2001).[5] The rationale is that prolonged closure of works, uncertainties about unemployment induces the skilled workers switching to alternative occupation. In other words, a '*fallback*' sector becomes a source of survival so that even skilled workers migrate to Z-'casual' sector conceived as '*savior of last resort*'-and arrest the rock-bottom fall in their own wages. This is attributed to downward mobility of S_X, S_Y to Z. On the contrary, L cannot move up to X, Y. Thus, the *second solution* entails when $W_X < W, W_Y < W$. With skilled migration to Z, 'W' could be depressed to such a low level that *in equilibrium*, it settles to lower values of W_X, W_Y. However, this is possible in this SF-model with substantially low P_X, P_Y altering wage structure, triggering downward mobility of S_X, S_Y, and disappearance of X and/or, Y when all S_X, S_Y '*effectively*' become L. Z-sector being labor-intensive is also CI-sector; X being virtual, CI impact is assumed away. However, as Y-sector faces imminent threat of obliteration, we focus on it alone.[6]

2.2 Impact: P_Y falls

Consider *ex post* GE effect for (1)—(7) to derive (Jones 1971):

$$\theta_{SX}\widehat{W_X} + \theta_{KX}\hat{r} = \widehat{P_X} = 0 \qquad (8)$$

$$\theta_{SY}\widehat{W_Y} + \theta_{KY}\hat{r} = \widehat{P_Y} \qquad (9)$$

$$\theta_{LZ}\widehat{W} + \theta_{KZ}\hat{r} = \widehat{P_Z} \qquad (10)$$

$$\theta_{SX} + \theta_{KX} = 1, \theta_{SY} + \theta_{KY} = 1, \theta_{LZ} + \theta_{KZ} = 1 \qquad (11)$$

For CIPS, income elasticity of demand is high. However, sluggish economic activities dampen demand due to income loss causing decline in prices (tickets) for 'performance'. Thus, even with lower prices Covid-19 containment hurts demand, squeezes expenditure (Y-sector demand inelastic). *Ceteris paribus*, $P_Y < 0$, $\widehat{P_X} = 0, \widehat{P_Z} = 0$, $\hat{Y} < 0$. K_Y falls, moving into X and Z. Marginal productivities (MP) of labors in X and Z rise with wages $W_X, W. W_Y$ falls. Thus,

---

[4] Switching skills or occupation entails long-run costly adjustments. However, this is extremely painful for less developed countries where unemployment benefits are scarce unlike in the advanced nations. However, Post-Covid, developed nations also face fiscal crunch making coffers empty.

[5] Goldin and Katz (1988) showed evidence of movement of white-collar workers to blue-collar sectors as commodity price changes.

[6] With contagion risks, skilled occupations in recreation sectors face threat of extinction. Creativity suffers under crisis.

Proposition 1: Given $\widehat{P_X} = 0, \widehat{P_Z} = 0,\ \widehat{P_Y} < 0\,,\ \widehat{W}_Y < 0, W_X$ and W both rise in absolute and relative terms, $\left(\widehat{\frac{W_X}{W_Y}}\right) > 0, \left(\widehat{\frac{W}{W_Y}}\right) > 0, \left(\widehat{\frac{W_X}{W}}\right) > 0$ Also, $\left(\widehat{\frac{W_X}{W}}\right) > 0$ *iff* $\theta_{KX} > \theta_{KZ}$.

Proof: discussion above and appendix.

As W_Y falls there is no guarantee that $W_Y \leq W$. Suppose due to fear of contagion and/or slack demand P_Y falls substantially to $\widetilde{P_Y}$ such that at $\widetilde{P_Y}$ for any S_Y >0, W_Y also falls much. Output falls, causing decline in employment and demand for S_Y. As very less S_Y $(\widetilde{S_Y}) > 0$ remains in Y, $W_Y < W$ and Y ceases to exist causing finite change. Thus, we write:

Proposition 2: *Iff* $P_Y \to 0$, i.e., substantially drops to $P_Y = \widetilde{P_Y}$ such that at $\widetilde{P_Y}$, any $S_Y > 0 \Rightarrow W_Y < W,$ then $\forall P_Y \leq \widetilde{P_Y}, Y = 0.$

Proof: discussion above.

If $\widehat{P_Y} < 0,$ then $\widehat{W_Y} < 0, \widehat{W} > 0.$ W_x, W_y decline below 'W'. Now $P_Y \cong 0 \Rightarrow W_Y \cong 0.$ Then $W > W_Y \cong 0.$ Everyone moves to Z-sector, $S_Y \to 0 \Rightarrow Y \to 0$, causing *disguised* unemployment in Z. By continuity, if $\widetilde{P_Y} \cong P_Y = 0$, the result must hold in the neighborhood. X and Z survive. Permanent damage will have an everlasting impact on wage structure resulting in 'forced exit' of the quasi-specific factors, finite change (polarization) with vanishing Y. This converges to SF-model with standard implications (Jones 1971):

$$W_s a_s + r a_{KX} = P_X \qquad (12)$$

$$W a_{LZ} + r a_{KZ} = P_Z \qquad (13)$$

$$a_s X = \overline{S} \qquad (14)$$

$$a_L Z = \overline{L} \qquad (15)$$

$$a_{KX} X + a_{KZ} Z = \overline{K} \qquad (16)$$

3. Conclusion and Outline of Extension:

We show that as the pandemic triggers closures of entertainment industry, high-wage workers undergo 'forced' reallocation to the casual sector. Online commerce flourishes.

Two extensions are contemplated:

(a) Moving one step back, so far as the decisions regarding occupational choice or skill formation is concerned, as 'creative sector' collapses, it's possible that people lack incentives to invest in becoming a performing star if the threat is permanently damaging. In other words, 'art' sector will be effaced gradually while virtual and informal sectors survive.

(b) With quality differentiation among the artists, we can model Y-sector as a continuum of differentiated talents with productivity spectrum $0 < \mu \leq 1$, higher μ implying more productive

peer performers. Let $a_{SY}(\mu), a'_{SY}(\mu) < 0, W_Y = f(\mu), f' > 0$ and $\mu = \tilde{\mu} \Rightarrow W_Y(\tilde{\mu}) = \tilde{W}$ be cut-off wage.

Thus, $W_y(\mu).a_{sy}(\mu) + r.a_{ky} = P_y$ (17)

In this type of a model we can show that only exceptionally talented entertainers i.e., for $\mu > \tilde{\mu}, \tilde{\mu} \to 1$ will remain in Y and the rest, for $0 < \mu < \tilde{\mu}$, will quit for Z, giving rise to intra-group inequality.

References

Baqaee, D., and Emmanuel Farhi (2021). Keynesian Production Networks and Covid-19 Crisis: A Simple Benchmark. American Economic Association (AEA) Papers and Proceedings, 111, 272-276

Barrero, J. S., Nicholas Bloom, S. J. Davis, and B. H. Meyer (2021). Covid-19 is a persistent reallocation shock. AEA Papers and Proceedings, 111, 287-291

Buesa, Alejandro., Javier J. Pérez, Daniel Santabárbara (2021). Awareness of pandemics and the impact of COVID-19, 204. 109892.

Crane, Leland D., R. A. Decker, Aaron Flaaen, Adrian Hamins-Puertolas, and Christopher Kurz (2020). Business Exit during the Covid-19 Pandemic. FEDS Working Paper 2020-089.

Das, G. G., et al (2020). The Impact of Immigration on Skills, Innovation and Wages: Education Matters more than where People come from. *Journal of Policy Modeling*. 42(3), 557-582

Famiglietti, Matthew, Leibovici, Fernando, and Santacreu, Ana Maria (2020).The Decline of Employment during COVID-19: The Role of Contact-Intensive Industries. Number 40. https://research.stlouisfed.org/publications/economic-synopses/2020/09/10/the-decline-of-employment-during-covid-19-the-role-of-contact-intensive-industries

Glocker, Christian and Philipp, Piribauer (2021). The determinants of output losses during the Covid-19 pandemic. *Economics Letters*, 204, 109923.

Goldin, C., Katz, L. (1998). The origins of technology-skill complementarity. Quarterly Journal of Economics 113, 693–732.

Grigsby, J., E. Hurst, A. Yildirmaz, and Y. Zhestkova (2021). Nominal wage adjustments during Pandemic Recession. AEA Papers and Proceedings, 111, 258—262

Jones, R.W. (1971). A three-factor model in theory, trade, and history. In: Bhagwati, J.N. et al. Eds.,Trade, Balance of Payments, and Growth: Essays in Honor of Charles P. Kindleberger. North-Holland, Amsterdam.

Jones, R.W. (2018). International Trade Theory and Competitive Models: Features, Values, and Criticisms. World Scientific Studies in International Economics: Volume 65

Jones, R.W. and S. Marjit (2009). Competitive Trade Models and Real World Features. Economic Theory, Vol. 41, No. 1 (Oct., 2009), 163-174

Karabulut, G., K. Zimmermann, M. H. Bilgin, A. C. Doker (2021). Democracy and COVID-19 outcomes, *Economics Letters*, 203, 109840.

Koren, M., and Peto, R. (2020). Business disruptions from Social Distancing. PLoS ONE. 15 (9):e0239113

Marjit, S. (1990). A simple production model in trade and its applications. *Economics Letters (32), 257-260.*

Marjit, S., M. Pant, and S. Huria (2020). Unskilled Immigration, Technical Progress, and Wages—Role of the Household Sector. Review of International Economics, 28 (1), 235-251

Marjit, S. and B. Mandal (2015). "Finite Change:Implications for Trade Theory, Policy and Development." In "Development in India", S. Mahendra Dev and P.G. Babu (Eds), Springer.

Ruffin, R. J. (1981). Trade and Factor Movements with three factors and two goods. Economics Letters 7, 177-182.

Ruffin, R. J. (2001). Quasi-specific factors: worker comparative advantage in the two-sector production model. Journal of International Economics 53, 445–461.

APPENDIX

Proof of Proposition 1:

From (8), (9), and (10), $\widehat{W_X} = -\frac{\theta_{KX}}{\theta_{SX}}\hat{r}$ (8a)

$\widehat{W_Y} = \left(\widehat{P_Y} \big/ \theta_{SY}\right) - \frac{\theta_{KY}}{\theta_{SY}}\hat{r}$ (9a)

$\widehat{W} = -\frac{\theta_{KZ}}{\theta_{LZ}}\hat{r}$ (10a)

Hence, $\widehat{P_Y} < 0 \Rightarrow \hat{r} < 0, \widehat{W_Y} < 0, \widehat{W_X} > 0, \widehat{W} > 0, \hat{Y} < 0$

Also, $\widehat{P_Y} < 0 = \widehat{P_X} \Rightarrow \widehat{W_Y} < \widehat{P_Y} < \hat{r} < 0 < \widehat{W_X}$

$\widehat{W_X} > 0 > \widehat{W_Y}$ and $\widehat{W} > 0 > \hat{r} \Rightarrow \widehat{\left(\frac{W}{W_Y}\right)} > 0, \widehat{\left(\frac{W_X}{W_Y}\right)} > 0.$

Further, $\widehat{W_X} > \widehat{W}$ iff $\frac{\theta_{KX}}{\theta_{SX}} > \frac{\theta_{KZ}}{\theta_{LZ}} \Rightarrow \theta_{KX}\theta_{LZ} > \theta_{KZ}\theta_{SX} \Rightarrow \theta_{KZ} < \theta_{KX}$ and

$\widehat{W_X} > \widehat{W_Y}, \widehat{W_X} > \widehat{W} \Rightarrow \widehat{W_X} > \widehat{W} > \widehat{W_Y}$ *iff* $\theta_{KX} > \theta_{KZ} > \theta_{KY}, \widehat{P_Y} < 0, \widehat{P_Z} < 0$ (QED.)

$\widehat{P_Z} < 0 \Rightarrow \widehat{\left(\frac{W_s}{W}\right)} > 0, \widehat{W} < \widehat{P_Z} < \hat{r} < \widehat{P_X} = 0 < \widehat{W_s}$