Macroeconomic Dynamics (2024), **29**, e32, pp. 1–11
doi:10.1017/S1365100524000488

ARTICLE

Industry clusters and macroeconomic (in)stability

Cheng-wei Chang

Department of Economics, Tunghai University, Taichung, Taiwan
Email: changcheng@thu.edu.tw

Abstract

While the competitive behavior of firms with regard to entry and exit activities serves as a driving force behind the business cycle, little attention has been paid to the issue of industry clusters when discussing belief-driven cyclical fluctuations. Faced with this deficiency, this study analyzes the possibility of the emergence of equilibrium indeterminacy from the perspective of industrial organization. By analyzing the effects of endogenous overhead costs in the market, this paper finds that belief-driven business cycle fluctuations are related to industry clusters. More specifically, a stronger spillover effect or a less pronounced congestion effect tends to increase the likelihood of local indeterminacy.

Keywords: Monopolistic competition; industry clusters; equilibrium indeterminacy

JEL classifications: D43; E32; L25

1. Introduction

The goods market is undoubtedly characterized by a high degree of product differentiation, which enables firms to gain some monopoly power in the market. In pursuing such product differentiation to remain competitive, some overhead costs, such as those related to advertising, marketing, transaction, and R&D expenditures, are gradually increasing and being used by firms actively operating in the market. At the same time, in a monopolistically competitive market with free entry and exit, the number of firms in the market will change once a firm earns a positive profit or incurs a loss. It is the process of firms entering and exiting the market that allows the market to evolve and adjust along with the changing economic environment, which is also an essential feature of a monopolistically competitive market.

A growing strand of the literature, such as Jaimovich and Floetotto (2008), Lewis (2009) and Clementi and Palazzo (2016), among others, examines how endogenous firm entry can contribute to understanding the business cycle. For example, Jaimovich and Floetotto (2008) develop a general equilibrium framework, indicating that an imperfect competition model with endogenous firm entry can explain U.S. job-gains (losses) at a higher frequency. In her study, Lewis (2009) shows that the number of firms varies over the business cycle and the correlation between aggregate output and net business formation is positive. Clementi and Palazzo (2016) document that endogenous firm entry plays a major role in shaping aggregate dynamics. All these studies suggest that a model with endogenous firm entry implies a dynamic response of the extensive margin and is able to match the business cycle dynamics. In other words, the economy may be subjected to higher macroeconomic volatility when the market structure is characterized by endogenous firm entry.[1]

To examine how the possibility of belief-driven cyclical fluctuations and equilibrium indeterminacy is related to the feature of endogenous firm entry and exit, a number of studies have devoted attention to discussing the issue in a monopolistic competition macroeconomic model with endogenous firm entry. For example, Chang et al. (2011) analyze the condition for local indeterminacy in a monopolistic competition model with such firm entry, finding that the condition for local indeterminacy depends on the degree of monopoly power. Chang et al. (2018) set up a monopolistic competition model featuring the returns to production specialization. Their analysis draws a distinction between production specialization and monopoly power, leading to the finding that the feature of production specialization plays an important role in governing local indeterminacy. Chen and Guo (2022) examine the interrelations between local indeterminacy and increasing returns to specialization within a monopolistic competition model. Their analysis shows that local indeterminacy can arise in the scenario where the increasing returns to production specialization are relatively strong.[2]

A common feature of these monopolistic competition models is that a firm's overhead costs are fixed.[3] However, the assumption of fixed overhead costs not only fails to reflect reality, but also results in an empirical tension. Accordingly, to provide an adequate explanation for variable overhead costs, overhead costs in this model are related to the number of firms (rather than being fixed), for which the correlation can be positive or negative. The introduction of this specification can be justified by discussing the following two reasons for its adoption.

First, in previous studies, Kim (2004) and Feng et al. (2017) document that, to make consumers aware of a brand and its product, a monopolistically competitive firm is inclined to enhance product differentiation through increasing advertising and marketing expenditures. In this case, in response to a rise in the number of firms in the market, an active firm will increase its overhead costs, such as those related to advertising and marketing expenditures, to create product differentiation. Prasad et al. (2009) set up an oligopoly model of advertising competition, showing that advertising expenditures will increase as the number of firms increases.

Second, Peretto (1999) documents that R&D expenditures are one component of the firm's total fixed costs and are negatively associated with the number of firms. A similar point is made by Peretto and Connolly (2007), who stress that, due to localized spillovers, it is less costly for new firms to innovate and enter the market with a larger number of firms. From the viewpoint of industry organization, Martin and Ottaviano (2001) stress that industry clusters of economic activities are likely to reduce an incumbent firm's overhead costs, such as those related to R&D, transaction and training costs, implying that overhead costs are negatively associated with the number of firms. To be specific, if the number of firms operating in the same industry is large, workers are more willing to enhance their professional skills and knowledge. This is because such professional skills are portable across firms in these industry clusters. In addition, when intermediate goods markets are located nearby, an incumbent firm can reduce its purchasing costs. As pointed out by Kamal and Sundaram (2016), industry clusters facilitate knowledge transfer and the sharing of information on business norms and culture, and also reduce transaction costs related to these economic activities. This also implies that overhead costs will decrease as the number of firms increases. Furthermore, by using the Longitudinal Firm Trade Transactions Database, Kamal and Sundaram (2016) show that overhead costs will decrease as the number of firms increases.

To reflect the importance of this industrial observation on overhead costs in the macroeconomic analysis, this paper contributes to the advancement of the literature on belief-driven business cycles by considering and analyzing the endogenous overhead costs. Compared with the existing literature on belief-driven business cycle models, this addition of endogenous overhead costs enables us to provide a further explanation as to how belief-driven business cycle fluctuations are related to the industry clusters by way of the mechanism resulting from the endogenous entry and exit of monopolistically competitive firms. The analysis is particularly important, since it is a new theoretical attempt to analyze industry clusters in relation to belief-driven business cycle fluctuations. Equipped with this feature, we show that the possibility of local indeterminacy is closely related to industry clusters. To be more precise, a higher degree of the spillover effect or a lower degree of the congestion effect tends to increase the likelihood of equilibrium indeterminacy.

The remainder of this paper is organized as follows. Section 2 sets up a monopolistically competitive model with firm entry and the endogeneity of overhead costs. Section 3 discusses the condition for equilibrium indeterminacy. Section 4 concludes the paper.

2. The model

We assume that the economy consists of two groups: firms and households. The production side of the economy consists of two sectors: the final good sector and the intermediate goods sector. The households derive utility from the consumption of the final good and disutility from labor supply.

2.1. Firms

Suppose that the final good Y is produced through the use of a range of differentiated intermediate inputs y_i. Following Bénassy (1996), final output is produced by a perfectly competitive firm with the following technology:[4]

$$Y = N^{\gamma+1-\frac{1}{\lambda}} \left(\int_0^N y_i^{\lambda} \, di \right)^{\frac{1}{\lambda}}, \tag{1}$$

where N is the number of intermediate goods, the parameter $\lambda \in (0, 1)$ measures the degree of monopoly power, and the parameter $\gamma (\geq 0)$ measures the extent of production specialization.

One point should be mentioned here. If all intermediate goods are produced in the same quantities, then the final output is expressed by $Y = N^{\gamma+1} y$. It turns out that in the presence of production specialization (i.e., $\gamma > 0$), a rise in the number of firms increases the production of final output more than proportionally, and this is referred to as the production-enhancing effect; see, example, Chang et al. (2018).

Assuming that the final good is the numéraire and that p_i is the price of the ith intermediate good, the profit-maximization problem for the final good firm can then be expressed as:

$$\underset{y_i}{Max} \; \pi^f = Y - \int_0^N p_i y_i \, di.$$

Accordingly, the solution for the first-order condition leads to the following expression:

$$p_i = N^{\lambda\left(\gamma+1-\frac{1}{\lambda}\right)} y_i^{\lambda-1} Y^{1-\lambda}. \tag{2}$$

Eq. (2) is the inverse demand function for the ith intermediate good, and the function is characterized by a price elasticity $1/(1-\lambda)$. A larger λ leads to a higher price elasticity, implying that the intermediate goods sector is more competitive. Therefore, λ measures the degree of monopoly power in the markets for intermediate products.

Intermediate good producers use capital and labor to produce a differentiated product, which they sell to the final good producers at the profit-maximizing price. The production technology for the ith intermediate good producer is given by

$$y_i = A k_i^a h_i^{1-a} - \Gamma, \tag{3}$$

where $A > 0$ is a constant technology parameter, k_i and h_i, respectively, denote the capital and labor hired by the ith intermediate good producer, $1 > a > 0$ is the share of capital, and Γ is the overhead cost.

To highlight the difference between the literature on belief-driven fluctuations and this paper, the overhead cost in the model is expressed as follows:

$$\Gamma = f N^{\sigma}, \; f > 0, \sigma \in (-1, \infty). \tag{4}$$

This general form allows us to consider three distinctive scenarios for the overhead cost. The first scenario in association with $\sigma = 0$ denotes the fixed effect. In this case, the overhead cost is fixed (i.e., $\Gamma = f$), and almost all existing studies including Chang et al. (2011), Pavlov and Weder (2012), Chang et al. (2018) and Chen and Guo (2022) adopt this specification. The second scenario in association with $\sigma \in (0, \infty)$ captures the congestion effect due to competitive differentiation, and denotes the viewpoint proposed by Kim (2004) and Feng et al. (2017): the greater the number of firms is associated with a higher overhead cost. The third scenario in association with $\sigma \in (-1, 0)$ captures the spillover effect from industry clusters, and reveals the Peretto and Connolly (2007) and Kamal and Sundaram (2016) viewpoint: the greater the number of firms is associated with a lower overhead cost.[5]

Let w and r respectively denote the market wage and capital rental rate. Based on the inverse demand function reported in Eq. (2) and the production function reported in Eq. (3), the optimization problem of the ith intermediate good producer can be expressed as

$$\underset{h_i\, k_i}{Max} \quad \pi_i^m = p_i y_i - w \; h_i - r \; k_i, \tag{5}$$
$$s.t. \text{ Eqs. (2) and (3).}$$

The first-order conditions with respect to h_i and k_i are

$$w = \frac{\lambda\,(1-a)\,p_i\left(y_i + fN^{\sigma}\right)}{h_i}, \tag{6}$$

$$r = \frac{\lambda a p_i\left(y_i + fN^{\sigma}\right)}{k_i}. \tag{7}$$

Then we obtain the profit of the ith intermediate good producer by substituting Eqs. (6) and (7) into (5):

$$\pi_i^m = p_i\left[(1-\lambda)\,y_i - \lambda f N^{\sigma}\right]. \tag{8}$$

The analysis is confined to a symmetric equilibrium under which $p_i = p$, $k_i = k$, $h_i = h$, and $y_i = y$ for all i. Let K and H denote the aggregate capital stock and labor inputs, respectively. We then have: $K = Nk$ and $H = Nh$.

The zero-profit condition of perfect competition in the final good sector yields the following result:

$$p = N^{\gamma}. \tag{9}$$

Moreover, free entry guarantees zero profits for the intermediate goods sector. As a result, the production of each intermediate good and the number of firms in equilibrium are given by

$$y = \frac{\lambda f N^{\sigma}}{1-\lambda}, \tag{10}$$

$$N = \left(\frac{(1-\lambda)\,AK^{a}H^{1-a}}{f}\right)^{\frac{1}{1+\sigma}}. \tag{11}$$

By inserting Eqs. (10) and (11) into (1), we can further obtain the aggregate production function as follows:

$$Y = \lambda\left(\frac{1-\lambda}{f}\right)^{\frac{\gamma}{1+\sigma}} A^{\frac{1+\sigma+\gamma}{1+\sigma}} K^{\frac{a(1+\sigma+\gamma)}{1+\sigma}} H^{\frac{(1-a)(1+\sigma+\gamma)}{1+\sigma}}. \tag{12}$$

Based on Eq. (12), the following condition should be imposed to ensure that the externality is not sufficiently strong to generate sustained growth:[6]

Condition NSG [the Nonsustained Growth Condition].

$$0 < \frac{a\,(1+\sigma+\gamma)}{1+\sigma} < 1. \tag{12'}$$

One point regarding Eqs. (10)–(12) should be stressed.[7] To compare the current endogenous overhead costs model with the fixed overhead costs model, we consider an extreme case of the fixed overhead costs scenario (i.e., $\sigma = 0$). In this extreme case, we find that the individual firm's output is fixed in equilibrium, and the number of firms is homogeneous of degree one in capital and labor. As a result, the aggregate production exhibits increasing returns to scale when $\gamma > 0$. By contrast, this paper considers the feature of endogenous overhead costs. In this scenario, the equilibrium individual firm's output is no longer fixed, and the number of firms is homogeneous of degree $1/(1+\sigma)$ in capital and labor. As a result, the aggregate production exhibits increasing returns to scale when $\gamma/(1+\sigma) > 0$. Equipped with this knowledge, the analysis finds that the endogenously-determined overhead costs are closely related to the number of firms and therefore give rise to the congestion effect and the spillover effect, thereby governing the impact of the number of firms on aggregate production.

2.2. Households

Consider an economy consisting of a unit measure of infinitely-lived households. The households maximize their lifetime utility U by deriving utility from consumption C but incurring disutility from labor supply H. Thus, the lifetime utility of the households can be expressed as

$$U = \int_0^{\infty} [\ln\ C_t - \zeta H_t]\, e^{-\rho\ t} dt,\ \rho > 0, \zeta > 0, \tag{13}$$

where ρ represents the rate of time preference, ζ measures the disutility from labor supply, and t is the time index.

The households face the following budget constraint:

$$\dot{K} = wH + rK + \Pi - C,^{8} \tag{14}$$

where $\Pi(= \int_0^N \pi_i^m\, di)$ refers to the aggregate profits transferred from intermediate good producers.

The households maximize the intertemporal utility reported in Eq. (13) subject to the budget constraint reported in Eq. (14). Performing the optimization problem leads to the following first-order conditions:

$$\frac{1}{C} = \mu, \tag{15}$$

$$\zeta = \mu\, w, \tag{16}$$

$$\mu\, r = -\dot{\mu} + \mu\, \rho, \tag{17}$$

together with Eq. (14) and the transversality condition $\lim_{t\to\infty} \mu\, K\, e^{-\rho\, t} = 0$, where μ is the shadow price of physical capital.

Eq. (15) represents the households' optimal consumption decision, Eq. (16) represents the households' optimal decision regarding labor supply, and Eq. (17) is associated with the households' optimal capital accumulation decision.

Combining Eq. (15) with (17) yields the familiar Keynes–Ramsey Rule:

$$\dot{C} = (r - \rho)\, C. \tag{18}$$

In addition, inserting Eqs. (3), (9), (11) and (12) into (6) and (7) yields:

$$w = \frac{(1-a)\,Y}{H}, \tag{19}$$

$$r = \frac{aY}{K}. \tag{20}$$

2.3. The Competitive Equilibrium

By substituting Eqs. (8), (19) and (20) into (14), we obtain the economy-wide resource constraint:

$$\dot{K} = Y - C. \tag{21}$$

Based on Eqs. (12), (15), (16) and (19), we can solve for employment for the instantaneous relationship:

$$H = H\,(K, C)\,, \tag{22}$$

where $H_K = \frac{\partial H}{\partial K} = \frac{-a(1+\sigma+\gamma)H}{\Omega K}$, $H_C = \frac{\partial H}{\partial C} = \frac{(1+\sigma)H}{\Omega C}$, and $\Omega = (1-a)(1+\sigma+\gamma) - (1+\sigma)$.

3. Macroeconomic (in)stability

In this section we examine the condition of local indeterminacy. Substituting Eqs. (12) and (20) into (18) and (21), the dynamic system of the economy can be expressed as

$$\dot{K} = \lambda \left(\frac{1-\lambda}{f}\right)^{\frac{\gamma}{1+\sigma}} A^{\frac{1+\sigma+\gamma}{1+\sigma}} K^{\frac{a(1+\sigma+\gamma)}{1+\sigma}} H^{\frac{(1-a)(1+\sigma+\gamma)}{1+\sigma}} - C, \tag{23}$$

$$\dot{C} = \left[a\lambda \left(\frac{1-\lambda}{f}\right)^{\frac{\gamma}{1+\sigma}} A^{\frac{1+\sigma+\gamma}{1+\sigma}} K^{\frac{a(1+\sigma+\gamma)}{1+\sigma}-1} H^{\frac{(1-a)(1+\sigma+\gamma)}{1+\sigma}} - \rho \right] C, \tag{24}$$

where H is given by Eq. (22).

Linearizing Eqs. (23) and (24) around the steady state $(\tilde{K}, \tilde{C})$ yields:

$$\begin{bmatrix} \dot{K} \\ \dot{C} \end{bmatrix} = \begin{bmatrix} J_{11} J_{12} \\ J_{21} J_{22} \end{bmatrix} \begin{bmatrix} K - \tilde{K} \\ C - \tilde{C} \end{bmatrix}, \tag{25}$$

where $J_{11} = \frac{-a(1+\sigma+\gamma)\tilde{Y}}{\Omega\tilde{K}}$, $J_{12} = \frac{(1-a)(1+\sigma+\gamma)\tilde{Y}}{\Omega\tilde{C}} - 1$, $J_{21} = \frac{-a\gamma\tilde{C}\tilde{Y}}{\Omega\tilde{K}^2}$, $J_{22} = \frac{a(1-a)(1+\sigma+\gamma)\tilde{Y}}{\Omega\tilde{K}}$.

Based on Eq. (25), we can infer the trace and determinant of the Jacobian:

$$Tr\,(J) = J_{11} + J_{22} = \frac{-a^2\,(1+\sigma+\gamma)\,\tilde{Y}}{\Omega\tilde{K}}, \tag{26}$$

$$Det\,(J) = J_{11}J_{22} - J_{12}J_{21} = \frac{a\left[(1-a)\,(1+\sigma+\gamma)\,\tilde{Y} - \gamma\tilde{C}\right]\tilde{Y}}{\Omega\tilde{K}^2}. \tag{27}$$

Based on Condition NSG, we can derive the following expression: $(1-a)(1+\sigma+\gamma)\tilde{Y} - \gamma\tilde{C} = [(1-a)(1+\sigma) - a\gamma]\tilde{Y} > 0$. Thus, the numerator of $Det(J)$ is positive. As a result, we can infer that $Det(J) > 0 (< 0)$ if and only if $\Omega = (1-a)(1+\sigma+\gamma) - (1+\sigma) > 0 (< 0)$.

3.1. The Condition for Equilibrium Indeterminacy

We are now in a position to examine how the feature of industry clusters affects the emergence of equilibrium indeterminacy. As addressed in the literature on dynamic rational expectations models, such as Liu and Turnovsky (2005), Brito and Dixon (2013), Lai and Chin (2013) and Chu et al. (2021), there exists a unique perfect foresight equilibrium solution if the number of unstable roots equals the number of jump variables. Since C is the only jump variable in this dynamic system, the steady-state equilibrium is locally determinate if only one of the roots is positive in the dynamic system, implying that the value of the determinant of the Jacobian is negative, that is, $Det(J) < 0$. Based on this cognition, we formulate the following constraint for saddle-point stability:

$$\Omega = (1-a)\,(1+\sigma+\gamma) - (1+\sigma) < 0. \tag{28}$$

However, as argued by Benhabib and Farmer (1994), Aguiar-Conraria and Wen (2008), Guo and Harrison (2010) and Lai et al. (2017), there exists a continuum of equilibrium paths converging to the steady state if the dynamic system has two negative roots, that is, $Det(J) > 0 > Tr(J)$. Therefore, the necessary and sufficient condition for our macroeconomy to exhibit local indeterminacy is that the two roots are both negative. Accordingly, we formulate the following constraint for equilibrium indeterminacy:

$$\Omega = (1-a)\,(1+\sigma+\gamma) - (1+\sigma) > 0. \tag{29}$$

The above discussion can be summarized by the following proposition:

Proposition 1. *Under Condition NSG,*

(i) the economy exhibits saddle-point stability if $\Omega = (1-a)(1+\sigma+\gamma) - (1+\sigma) < 0$;

(ii) the economy displays local indeterminacy if $\Omega = (1-a)(1+\sigma+\gamma) - (1+\sigma) > 0$.

It is clear that the condition for equilibrium (in)stability is closely related to the capital share a, the degree of production specialization γ, and the extent of industry clusters σ. Therefore, we in turn examine how the possibility of local indeterminacy is related to each of these factors.

Two points related to the condition for local indeterminacy should be mentioned. First, in previous studies, Chang et al. (2018) and Chen and Guo (2022) focus on the situation where the feature of industry clusters is absent (i.e., $\sigma = 0$). As a result, their analysis finds that local indeterminacy can occur, provided that the degree of production specialization is relatively large. Second, our analytical result further indicates that the condition for local indeterminacy crucially depends upon the effect of industry clusters, in addition to the returns to production specialization proposed in the existing literature.[9]

We first discuss the linkage between the possibility of equilibrium indeterminacy and the extent of production specialization γ. Our intuitive explanation for this result is borrowed from Benhabib and Farmer (1994). The condition for equilibrium indeterminacy requires that the equilibrium wage-hours locus be positively sloped and steeper than the labor supply curve. Accordingly, the condition for equilibrium indeterminacy can be expressed as[10]

$$\frac{(1-a)\,(1+\sigma+\gamma)}{1+\sigma} - 1 > 0. \tag{30}$$

When the households generate optimistic expectations as regards having a higher future return on capital, they will tend to increase their investment today, implying that the capital stock in the next period will increase. Given that labor and physical capital are complements in production, labor supply in the next period will increase, implying that more output will be produced, and this will in turn attract a greater number of firms to enter and produce in the market. In the presence of increasing returns to production specialization (i.e., $\gamma > 0$), a higher value of γ further reinforces the labor productivity via the production-enhancing effect, which is reflected by the

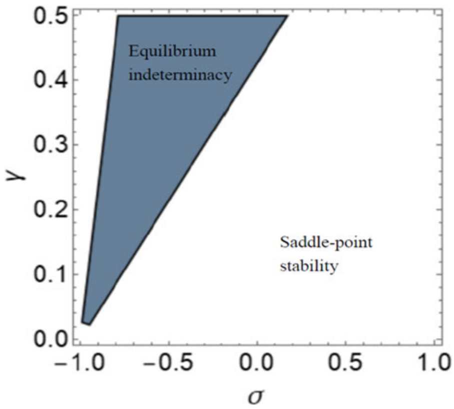

Figure 1. The saddle-point stability and equilibrium indeterminacy regions.

factor γ on the left-hand side of Eq. (30). As a consequence, the economy is more susceptible to local indeterminacy when the magnitude of the production specialization is relatively large. In fact, this result is reminiscent of Chang et al. (2018) and Chen and Guo (2022).

We then deal with how the possibility of equilibrium indeterminacy is related to the effect of industry clusters σ. As described above, when the households become optimistic, the number of firms will increase in response. When more firms are being set up, an incumbent firm will raise its overhead costs due to the presence of the congestion effect (i.e., $\sigma > 0$), and this will restrain firms from entering and producing in the market. To be specific, a higher value of σ reduces the contribution of the production-enhancing effect of entry and therefore weakens the labor productivity, which is reflected by the factor σ on the left-hand side of Eq. (30). As a result, the presence of the congestion effect mitigates the possibility of local indeterminacy. By contrast, in the presence of the spillover effect (i.e., $\sigma < 0$), an incumbent firm could reduce overhead costs when more firms are being set up, which may induce more firms to enter and produce in the market. As a result, the presence of the spillover effect enhances the contribution of the production-enhancing effect of entry and therefore reinforces the labor productivity, thereby increasing the possibility of local indeterminacy.

The above discussion can be summarized by the following proposition:

Proposition 2. *In a monopolistic competition model with endogenous entry and industry clusters, a higher degree of production specialization and the spillover effect or a lower degree of the congestion effect tends to increase the possibility of the emergence of equilibrium indeterminacy.*

3.2. Quantitative Analysis

To perform further quantitative analysis for the emergence of local indeterminacy, in this subsection we provide a quantitative assessment by resorting to a numerical analysis. Figure 1 is drawn to highlight the effect of both γ and σ on the likelihood of equilibrium (in)determinacy. To compare our results with those of existing studies, the capital share is set to $a = 0.3$, a value used in Benhabib and Farmer (1996), Chang and Lai (2017), Chen and Guo (2022) and many previous studies in the literature on belief-driven business cycles. We vary the extent of production specialization γ from 0 to 0.5 and the industrial cluster effect σ from -1 to 1 to highlight its importance. As can be seen from Figure 1, the $\sigma - \gamma$ space is divided into three areas. The white area at the lower right displays the region featured by saddle-point stability (i.e., $\Omega < 0$), the gray area at the upper middle depicts the region featured by equilibrium indeterminacy (i.e., $\Omega > 0$), while the white area at the upper left depicts the region that does not satisfy Condition NSG.

Three important results emerge from Figure 1. First, as indicated in Figure 1, a higher degree of production specialization matched with a higher degree of the spillover effect (a lower σ) or a lower degree of the congestion effect tends to increase the likelihood of local indeterminacy. Second, as in Chang et al. (2018) and Chen and Guo (2022), in the absence of the industrial cluster effect (i.e., $\sigma = 0$), local indeterminacy can occur, provided that the degree of production specialization is relatively large. To be more specific, the minimum degree of production specialization required for local indeterminacy is $\gamma_{\min} = 0.429$. Third, Kasahara and Rodrigue (2008) indicate that the estimated degree of production specialization can be as high as 0.3. Given this parameter value, we have the minimum level of industry clusters required to satisfy the condition for local indeterminacy. To be more specific, the minimum level of industry clusters required for local indeterminacy is $\sigma_{\min} = -0.3$ given that $\gamma = 0.3$.

4. Conclusion

This paper develops a monopolistic competition macroeconomic model in which overhead costs are related to the number of firms. We then use the model to analyze the possibility of equilibrium indeterminacy and belief-driven cyclical fluctuations from the perspective of industrial organization. Two main findings emerge from the analysis. First, in the absence of an industrial cluster effect, equilibrium indeterminacy can occur, provided that the degree of production specialization is relatively large. Second, a higher degree of the spillover effect or a lower degree of the congestion effect tends to raise the likelihood of equilibrium indeterminacy.

Acknowledgment. I am deeply grateful to William A. Barnett (Editor), Roger Farmer (Co-Editor), and two anonymous referees for their insightful and constructive comments that have substantially improved the paper. Any shortcomings are, however, my responsibility.

Notes

1 In their empirical studies, Bernard et al. (2010) and Broda and Weinstein (2010) emphasize the importance of the extensive margin in the process of product creation or innovation, and further explore the role of endogenous firm entry in relation to the business cycle.

2 With regard to local indeterminacy in a monopolistic competition model with endogenous firm entry, see also, for example, Dos Santos Ferreira and Lloyd-Braga (2008), Pavlov and Weder (2012) and Chang and Lai (2017).

3 According to Hornstein (1993, p. 301), the overhead cost refers to expenses "for administration purposes to keep production going." Equipped with this definition, the overhead cost, including items such as advertising, training and R&D expenditures, could be viewed as the expenses in each period that all active firms incur to stay in business. Conceptually, the overhead cost is different from the market entry cost. To be specific, to enter the market a firm has to pay an entry cost, which is therefore sunk after entry. This paper does not consider prospective entrants in the model economy and therefore does not deal with the sunk entry cost. See, for example, Bilbiie et al. (2012), Melitz and Redding (2015), Savagar and Dixon (2020) and Chang and Lai (2024) for a detailed discussion.

4 To simplify the notation, in what follows the time subscript of all variables is omitted except in cases where it should be brought to the reader's attention.

5 See also, for example, Chang (2020), Baumgarten et al. (2022) and Chang and Lai (2024).

6 It should be noted that, as documented by Benhabib and Farmer (1994), the model economy can sustain endogenous growth if the externalities are sufficiently large such that the aggregate production is linear in capital. Based on this cognition, we can infer that, when externalities are absent, Condition NSG should naturally be satisfied. In addition, for the sake of a convenient comparison and in line with existing studies, such as Chang et al. (2011), Chang et al. (2018) and Chen and Guo (2022), this study imposes Condition NSG to rule out the possibility that the model economy can sustain endogenous growth.

7 This point was raised by an anonymous referee, to whom I am grateful.

8 For simplicity and without loss of generality, the depreciation rate of physical capital is set to zero.

9 It should be mentioned that, in their study, Chang et al. (2011) specify a parameter to capture both production specialization and monopoly power. By contrast, this study specifies two distinct parameters to reflect production specialization and monopoly power. Accordingly, the analysis indicates that the condition for equilibrium indeterminacy is closely related to the degree of production specialization (rather than monopoly power). Furthermore, Chang et al. (2011) confine their analysis to the fixed overhead costs scenario. By contrast, this study instead introduces endogenous overhead costs to a monopolistic competition macroeconomic model with endogenous entry, showing that the feature of industry clusters plays an important role in governing equilibrium indeterminacy.

10 It should be noted that this constraint can be transformed into Eq. (29) by means of simple manipulations. See also, for example, Chen and Guo (2022).

References

Aguiar-Conraria, L. and Y. Wen. (2008) A note on oil dependence and economic instability. *Macroeconomic Dynamics* 12(5), 717–723.

Baumgarten, D., M. Irlacher and K. Mayr-Dorn. (2022) Internationalization strategies of multi-product firms: The role of technology. *Canadian Journal of Economics* 55(4), 1929–1965.

Benassy, J.-P. (1996) Taste for variety and optimum production patterns in monopolistic competition. *Economics Letters* 52(1), 41–47.

Benhabib, J. and R. Farmer. (1994) Indeterminacy and increasing returns. *Journal of Economic Theory* 63(1), 19–41.

Benhabib, J. and R. Farmer. (1996) Indeterminacy and sector-specific externalities. *Journal of Monetary Economics* 37(3), 421–443.

Bernard, A. B., S. J. Redding and P. K. Schott. (2010) Multiple-product firms and product switching. *American Economic Review* 100(1), 70–97.

Bilbiie, F. O., F. Ghironi and M. C. Melitz. (2012) Endogenous entry, product variety, and business cycles. *Journal of Political Economy* 120(2), 304–345.

Brito, P. and H. D. Dixon. (2013) Fiscal policy, entry and capital accumulation: Hump-shaped responses. *Journal of Economic Dynamics and Control* 37(10), 2123–2155.

Broda, C. and D. E. Weinstein. (2010) Product creation and destruction: Evidence and price implications. *American Economic Review* 100(3), 691–723.

Chang, C. W. (2020) Endogenous overhead costs, firm size, and fiscal shocks. *Scottish Journal of Political Economy* 67(2), 223–230.

Chang, C.-W. and C.-C. Lai. (2017) Macroeconomic (in)stability and endogenous market structure with productive government expenditure. *Studies in Nonlinear Dynam ics and Econometrics* 21(2), 1–16.

Chang, C.-W., C.-C. Lai and J.-J. Chang. (2018) Fiscal stimulus and endogenous firm entry in a monopolistic competition macroeconomic model. *The Japanese Economic Review* 69(2), 207–225.

Chang, C.-W. and T.-W. Lai. (2024) Government spending and monopolistic competition with heterogeneous firm productivity. *Journal of Economics* 141, 101–135.

Chang, J.-J., H.-W. Hung and C.-C. Huang. (2011) Monopoly power, increasing returns to variety, and local indeterminacy. *Review of Economic Dynamics* 14(2), 384–388.

Chen, S.-H. and J.-T. Guo. (2022) Equilibrium indeterminacy, endogenous entry and exit, and increasing returns to specialization. *Macroeconomic Dynamics* 26(7), 1756–1774.

Chu, A. C., C.-H. Liao, X. Liu and M. Zhang. (2021) Indeterminacy in a matching model of money with productive government expenditure. *International Review of Economics and Finance* 71, 497–516.

Clementi, G. L. and B. Palazzo. (2016) Entry, exit, firm dynamics, and aggregate fluctuations. *American Economic Journal: Macroeconomics* 8(3), 1–41.

Dos Santos Ferreira, R. and T. Lloyd-Braga. (2008) Business cycles with free entry ruled by animal spirits. *Journal of Economic Dynamics and Control* 32(11), 3502–3519.

Feng, L., Z. Li and D. L. Swenson. (2017) Trade policy uncertainty and exports: Evidence from China's WTO accession. *Journal of International Economics* 106, 20–36.

Guo, J.-T. and S. G. Harrison. (2010) Indeterminacy with no-income-effect preference and sector-specific externalities. *Journal of Economic Theory* 145(1), 287–300.

Hornstein, A. (1993) Monopolistic competition, increasing returns to scale, and the importance of the productivity shocks. *Journal of Monetary Economics* 31(3), 299–316.

Jaimovich, N. and M. Floetotto. (2008) Firm dynamics, markup variations, and the business cycle. *Journal of Monetary Economics* 55(7), 1238–1252.

Kamal, F. and A. Sundaram. (2016) Buyer-seller relationships in international trade: Do your neighbors matter? *Journal of International Economics* 102, 128–140.

Kasahara, H. and J. Rodrigue. (2008) Does the use of imported intermediates increase productivity? Plant-level evidence. *Journal of Development Economics* 87(1), 106–118.

Kim, J. (2004) What determines aggregate returns to scale? *Journal of Economic Dynamics and Control* 28(8), 1577–1594.

Lai, C.-C. and C.-T. Chin. (2013) Monetary rules and endogenous growth in an open economy. *Macroeconomic Dynamics* 17(2), 431–463.

Lai, C.-C., C.-T. Chin and K.-J. Chen. (2017) Oil dependence, international borrowings, and economic instability in a small open economy. *Macroeconomic Dynamics* 21(4), 889–917.

Lewis, V. (2009) Business cycle evidence on firm entry. *Macroeconomic Dynamics* 13(5), 605–624.
Liu, W.-F. and S. J. Turnovsky. (2005) Consumption externalities, production externalities, and long-run macroeconomic efficiency. *Journal of Public Economics* 89(5-6), 1097–1129.
Martin, P. and G. Ottaviano. (2001) Growth and agglomeration. *International Economic Review* 42(4), 947–968.
Melitz, M. J. and S. J. Redding. (2015) New trade models, new welfare implications. *American Economic Review* 105(3), 1105–1146.
Pavlov, O. and M. Weder. (2012) Variety matters. *Journal of Economic Dynamics and Control* 36(4), 629–641.
Peretto, P. F. (1999) Firm size, rivalry and the extent of the market in endogenous technological change. *European Economic Review* 43(9), 1747–1773.
Peretto, P. F. and M. Connolly. (2007) The manhattan metaphor. *Journal of Economic Growth* 12(4), 329–350.
Prasad, A., S. P. Sethi and P. A. Naik. (2009) Optimal control of an oligopoly model of advertising. *IFAC Proceedings Volumes* 42, 91–96.
Savagar, A. and H. D. Dixon. (2020) Firm entry, excess capacity and endogenous productivity. *European Economic Review* 121, 103339.

Cite this article: Chang C-w (2024). “Industry clusters and macroeconomic (in)stability.” *Macroeconomic Dynamics* **29**(e32), 1–11. https://doi.org/10.1017/S1365100524000488