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Chapter Author: Julio J. Rotemberg

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Comment

Julio J. Rotemberg, Harvard Business School and NBER

This paper by Bilbiie, Ghironi, and Melitz (BGM) provides a useful sequel to their already influential 2006 paper. The earlier paper introduced a tractable dynamic monopolistic competition model where entry was handled in an attractive manner. By paying an entry fee, any firm could become a symmetric monopolistically competitive producer. While many earlier papers had considered the case where there was a fixed cost that an imperfectly competitive firm needed to pay each period, Bilbiie, Ghironi, and Melitz (2006) neglected period-by-period fixed costs and supposed that all fixed costs had to be paid just once. For describing the behavior of entrants, this assumption has considerable a priori appeal.

One empirical difficulty with interpreting this model as a model of entry, however, is that new entrants tend to be small firms that grow only slowly over time. By contrast, this is a model where firms immediately become as large as the typical firm after they pay their entry cost. BGM thus prefer to interpret this model as one where firms are increasing the number of varieties that they sell and where the fixed cost is the cost of adding a variety. This interpretation has an important side benefit, namely that it focuses macroeconomists' attention on the indubitable fact that most firms sell a variety of different products.

The current paper extends the BGM framework by letting firms have rigid prices (a step toward realism that I welcome) and uses the resulting model to study the consequences of monetary policy. This has the advantage of bringing to light some unexpected consequences of how one models entry costs and the labor market in sticky price models. These lessons are particularly well illustrated by two of the model's empirical failures. The first is that, at least in the benchmark version of the model, BGM conclude that monetary expansions should reduce the number of firms (or products). For the case of the number of firms, Bergin and Corsetti (2005) show that identified monetary policy shocks in a VAR increase the number of firms (and this result has been replicated by Lewis [2006]). The second is that, for output expansions induced by technology shocks, the current BGM paper features unrealistically large countercyclical movements in markups.

My discussion is organized as follows. First, I show that a much simpler model of entry can explain why entry is procyclical in a model with no technology shocks, that is, in a model where output fluctuations are the result of variations in the markup of final goods. Second, I discuss some evidence concerning the cyclical behavior of the number of new products. This evidence is a great deal scarcer than the evidence on the number of firms, but, as suggested earlier, is probably of at least equal importance for macroeconomists. One interesting aspect of this evidence is that, at least for the data I have been able to find, the number of products is not very strongly procyclical. Third, I discuss one of the important reasons why the benchmark version of this model has entry falling in response to monetary policy expansions. This is that the labor market is modeled in such a way that real wages are much more procyclical than they are in reality. Last, I show that this weakness in modeling the labor market also explains the finding that markups are excessively countercyclical in response to technology shocks.

1 A Simple Model of the Equilibrium Number of Firms

Suppose that final producers have a production function given by

$$Y_t^i = (M_t^i)^\alpha \tag{1}$$

where Y_t^i represents output by firm i at t while M_t^i represents this firm's use of materials at t. In the simplest case, there is an economy-wide market for materials so that

$$\sum_i M_t^i = M_t = \sum_j q_t^j$$

where M_t equals the total available materials and q_t^j is the output of intermediate firm j. Materials are produced with labor, which earns a wage w_t. The labor requirement to produce q_t^j is

$$L_t^j = q_t^j[x + a(q_t^j - \bar{q})^2]$$

where x is a constant. While this may seem like an unusual functional form, it has the benefit of yielding a U-shaped average cost function with minimum average cost equal to xw_t.

Marginal cost is then equal to

$$[x + a(q_t^i - \bar{q})^2 + 2a(q_t^i - \bar{q})q_t^i]w_t.$$

Perfect competition implies that the price of the intermediate input equals marginal cost. Firms then enter whenever this price exceeds average cost. This ensures that all intermediate good firms produce at efficient scale $\bar{q}$ and that the price of the intermediate good v_t is given by

$$v_t = xw_t.$$

The number of firms producing intermediate goods n_t equals

$$n_t = M_t/\bar{q}.$$

From both the point of view of workers and from the point of view of the final goods producers, this model is equivalent to one where final goods are produced according to

$$Y_t^i = (L_t^i/x)^\alpha.$$

In either case, marginal cost of the final good is $w_t L_t^i/(\alpha Y_t^i)$.

An immediate implication of this model is that increases in output lead to increases in the number of firms producing intermediate inputs. Since the technologies for producing both the final and intermediate goods are held constant in this exercise, this increase in output must be the result of reductions in the markup of the final goods producers. Thus, this model predicts that the number of intermediate firms would rise if there was an expansionary monetary policy and final goods producers had sticky prices. It should be noted, however, that matching the actual dynamics of entry probably requires a substantially more complex model because, as in Lewis (2006), one probably needs further adjustment costs. I return to this issue in the following discussion.

2 How Does the Number of Products Vary Cyclically?

It is well known that the number of firms is quite procyclical. But because most new firms are small, the importance of this phenomenon for pricing, aggregate output, and aggregate employment remains unknown. I thus applaud this paper's emphasis on the number of products produced by any given firm. Unfortunately, relatively little is known about the time-series properties of product variety. A recent study by Broda and Weinstein (2007) breaks new ground in this area, and finds that the number of UPC codes found in consumers' purchases is quite procyclical. However, this study includes only six years of data (of which only the period 1999–2003 involves consecutive observations). While it does include one recession, the 2001 recession may have been special, because it was connected to the collapse of the dot.com bubble.

I thus consider two additional sources of information on this issue. The first is data assembled by Devinney (1990) and Axarloglou (2003) on the number of new products that were announced in the pages of the Wall Street Journal.[1] The quarterly Devinney data cover the period 1975:1–1984:4, while the Axarloglou (2003) data cover the period 1984:1–1994:2. Unfortunately, the methods used by these two researchers are not identical, though their series behave similarly over the period that they have in common. These data, as well as a cyclical indicator obtained by detrending GDP using the method of Rotemberg (2003), are depicted in figure 5C2.1.

The plot does not reveal strong responses of product introductions to either the 1990 or 2001 recession, nor do they involve a large increase after the 1974 recession. The correlation between the Devinney (1990) data on the log of product introduction and cyclical GDP is actually –0.34, while that between the Axarloglou (2003) data on the log of introductions and cyclical GDP is –0.40. The correlations between the change in

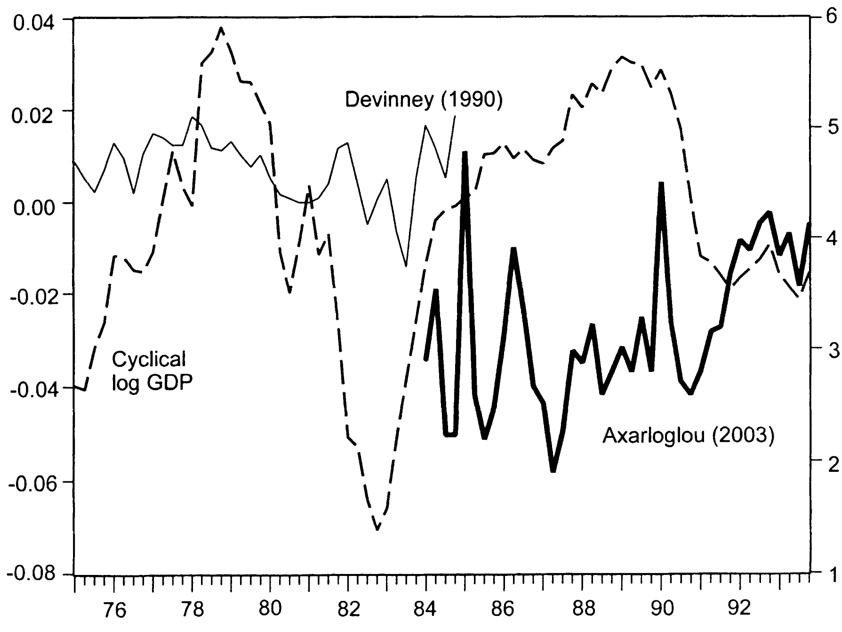

Figure 5C2.1
Cyclical GDP and Log of Wall Street Journal New Product Announcements

the log of introductions and the change in cyclical GDP is –0.57 in the early period while it is 0.65 in the latter. This latter finding provides some support for the idea that product introductions are procyclical, but the overall evidence for this proposition seems weak from these data.[2]

An even more readily available series on the number of available products of a certain type is available from *Ward's Automobile Reports.* This publication lists new car registrations in each calendar year by "nameplate." A nameplate is a sub-brand, like the Chevrolet Impala or Mercury Cougar. When a particular sub-brand has two different body types (such as a sedan and wagon), they appear as different nameplates. Other differences, such as differences in trim, engine, or options do not appear as separate nameplates. The number of nameplates in a particular year is thus a crude measure of product variety, but it has the advantage of being readily available and easy to define.

Data on foreign automobiles is not available consistently from 1955, while data on U.S. -made cars is. Figure 5C2.2 thus shows the logarithm of the number of U.S. nameplates as well as the measure of cyclical GDP discussed previously. The correlation between these series is fairly low. It equals 0.22 using the 1955–2005 sample, whereas it equals only 0.08 if one removes the 1959 observation. My conclusion from this is that models where the variety of final output is procyclical are worth exploring,

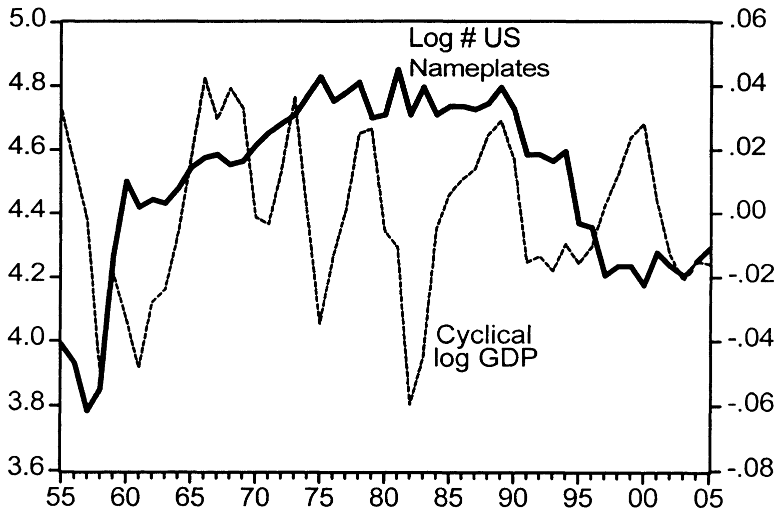

Figure 5C2.2
Cyclical GDP and Log of the Number of U.S. Automobile Nameplates in New Registrations

but that the relationship between product variety and business cycles appears to be fairly complex.

3 Entry and Monetary Policy in the BGM Model

I now provide a simplified exposition of some aspects of the BGM model so as to show that an important reason for its conclusion that entry falls after monetary expansions is due to its model of the labor market. To illustrate this, I consider the incentives to enter in a model with a fixed number of firms and I show that, when the labor market is modeled as in BGM, this incentive falls when output rises.

To calculate this incentive suppose that, if a firm were to enter, it would receive a fixed fraction of the total profits available for as long as the firm stays alive. Suppose it expects a probability δ of disappearing in each period and that the entry cost consists of a fixed amount of labor. Entry is then attractive if

$$E_t \sum_i [\beta(1-\delta)]^i \left(\frac{C_t}{C_{t+i}}\right)^{\gamma} \pi_{t+i} \geq w_t f_E \qquad (2)$$

where f_E is a constant while π_t and C_t represent profits and consumption, respectively.

With $Y_t = C_t$ and constant returns, real profits at t are

$$\pi_t = C_t(P_t - MC_t)/P_t = C_t(1 - 1/\mu_t) \qquad (3)$$

where MC_t is marginal cost at t and the second equality is based on defining the markup μ_t as P_t/MC_t. At the same time, the production function

$$C_t = (L_t)^{\alpha}$$

implies that the markup is given by

$$\mu_t = \frac{\alpha(L_t)^{\alpha-1}}{w_t} = \frac{\alpha(C_t)^{(\alpha-1)/\alpha}}{w_t}. \qquad (4)$$

Now let variables with tildes denote log deviations around a steady state. Differentiating (3) gives

$$\tilde{\pi}_t = \left(\frac{1}{\mu - 1}\right)\tilde{\mu}_t + \tilde{C}_t,$$

so that profits rise with output and with markups. Differentiating (4), we obtain

$$\tilde{\mu}_t = -\tilde{w}_t - \frac{1-\alpha}{\alpha}\tilde{C}_t,$$

which implies

$$\tilde{\pi}_t = \left(\frac{-1}{\mu - 1}\right)\tilde{w}_t + \left[1 - \frac{1-\alpha}{\alpha(\mu-1)}\right]\tilde{C}_t.$$

This shows that profits fall when the real wage rises, while they rise with output as long as $\alpha\mu > 1$. This condition is necessary for profits to be procyclical in response to changes in markups. Since BGM assume that $\alpha = 1$, this condition is always satisfied in their paper. This condition is not sufficient, however. Profits rise only if the resulting real wage increases are suitably modest. Indeed, since they suppose that the average markup μ is less than 2 while $\alpha = 1$, profits fall unless wages rise considerably less than output. The big question, then, is what determines the real wage.

BGM follow a traditional route, which is to suppose that real wages make workers indifferent between a marginal increase in leisure and the marginal increase in consumption that can be afforded by giving up this leisure for work. While this assumption has not proved deleterious in other New Keynesian models, it proves quite problematic here. To see this, consider individual preferences such that instantaneous utility is given by

$$\frac{C^{1-\gamma}}{1-\gamma} + \chi\frac{L^{1+1/\varphi}}{1+1/\varphi}.$$

With these preferences, a clearing labor market requires that

$$(C_t)^{-\gamma} w_t = \chi(L_t)^{1/\varphi}.$$

Differentiation near a steady state then yields

$$\tilde{w}_t = \left(\frac{1}{\varphi} + \gamma\right)\tilde{C}_t.$$

BGM assume that $\gamma = 1$ so that the wage rises by at least 1 percent every time output (or consumption) rises by 1 percent. Lower values of the Frisch elasticity φ accentuate this effect. Equation (3), on the other hand, implies that profits fall when output rises, even if wages only rise by the same percentage as output. With wages rising and profits falling, the inequality (2) is more likely to be violated, so that the incentive to enter falls. The conclusion from this is that the incentive to enter can rise only if increases in wages are suitably modest. In practice, real wages are only slightly procyclical, so the case where entry becomes more attractive can easily be the most empirically valid one.

This discussion explains the contrast between the results in this paper and those of Lewis (2006). She assumes that nominal wages (as opposed to the prices for goods) are rigid and finds that output rises after a monetary expansion. An alternative is to suppose that entry costs involve the purchase of goods whose prices are sticky. This is the route pursued by Bergin and Corsetti (2005) and Elkhoury and Mancini Griffoli (2006). As long as entry costs fall relative to the future value of profits, entry rises, and BGM cover this case in an extension. The point of my discussion, however, is that realistic changes in real wages might well make entry procyclical even if all entry costs take the form of hiring additional labor.

The model's implication, that real wages rise quickly with consumption and employment, is also responsible for the finding that markups can be excessively countercyclical in response to technology shocks. To see this, remember that in the BGM model with a variable number of firms, the total amount of labor hired, L_t, is given by

$$L_t = N_t L_t^C + \frac{N_{E,t} f_e}{Z_t},$$

where N_t is the number of firms, L_t^C is the number of workers each of these firms hires to produce consumption goods, $N_{E,t}$ is the number of new firms (or products), and Z_t is an index of technology. In this equation, increases in technology reduce the number of employees needed to start a firm so as to keep the startup costs in proportion to the amount of labor needed to produce a given level of output.

With sticky prices and without entry, increases in Z_t usually lower labor demand. The reason is that the stickiness of prices prevents firms from selling a great deal more, so they need fewer workers to produce the quantity demanded.[3]

Here, however, there is a countervailing effect, namely that new firms wish to enter—and this requires that additional workers be hired. In the calibration of this paper, total labor demand actually rises and, for the reasons discussed earlier, this pushes wages up considerably. With $\alpha = 1$, this is the same as saying that the markup falls a great deal. This effect can be reduced by making real wages respond less to output. However, it would probably also help the model perform better if adjustment costs were added so that there would be a dampened response of entry to technology shocks. Aside from being consistent with relatively small changes in entry, such a modeling change would also avoid bursts in labor demand when technology improves.

Endnotes

1. The Devinney (1990) data were extracted from a quarterly plot in his paper. Kostas Axarloglou kindly sent me the quarterly aggregate data underlying his analysis.

2. Both Devinney (1990) and Axarloglou (2003) emphasize that they find empirical connections between product introductions and aggregate output, but they consider more complex regressions where the number of introductions is allowed to depend on lagged growth rates of GDP as well.

3. Galí (1999) showed this effect to exist empirically, and gave this explanation.

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