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Working Paper

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KOF Working Papers, No. 243

Provided in Cooperation with:
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Suggested Citation: Hartwig, Jochen (2009) : D and Z in ROPE: Will the real Keynes please stand up?, KOF Working Papers, No. 243, ETH Zurich, KOF Swiss Economic Institute, Zurich, https://doi.org/10.3929/ethz-a-005995954

This Version is available at:
https://hdl.handle.net/10419/50344

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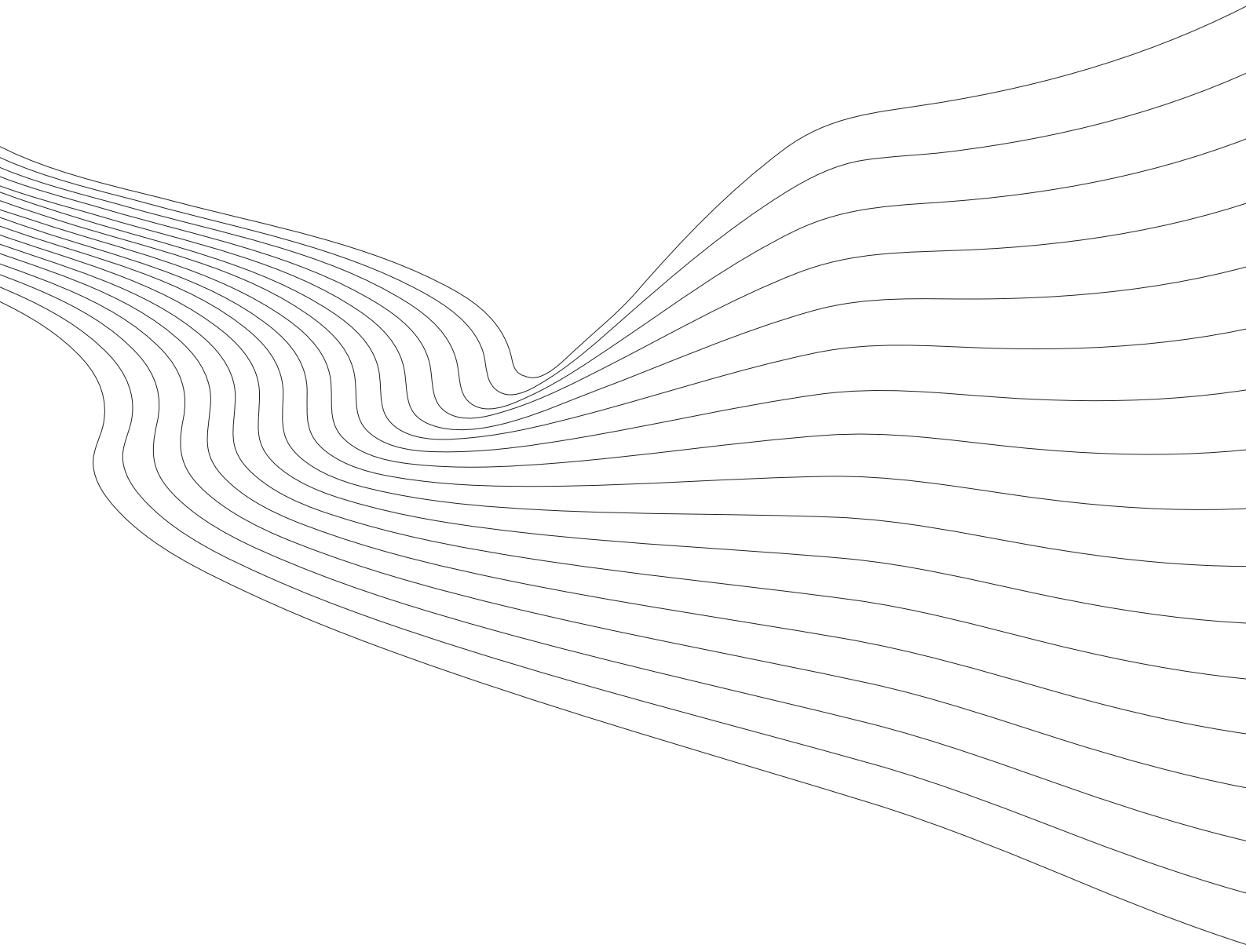

No. 243
November 2009

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D and *Z* in *ROPE* – Will the real Keynes please stand up?

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Keywords: Keynes's D/Z model, effective demand, Post Keynesianism

JEL classification: E12

Abstract

The *Review of Political Economy* (ROPE) welcomed the year 2009 with an issue in which the first two articles use an interesting yet not very popular modeling framework, namely the aggregate demand/aggregate supply (D/Z) model from Chapter 3 of Keynes's *General Theory*. Unfortunately, as I intend to show in this paper, the interpretations of Keynes's D/Z-model proposed by these two articles contradict each other. To resolve this unsatisfactory state of affairs, I will offer an evaluation of which of the two interpretations is more in line with Keynes's own suggestions.

1. Introduction

In Chapter 3 of the *General Theory*, Keynes develops a macroeconomic model in which two functions, which he calls D and Z, determine the volume of aggregate employment at their point of intersection. Keynes (1936, p. 25) names Z the '*Aggregate Supply Function*', D the '*Aggregate Demand Function*', and their point of intersection '*the effective demand*'. Since Keynes (1936, p. 89) makes it clear that "(t)he ultimate object of our analysis is to discover what determines the volume of employment", Chapter 3 can be assumed to contain important insights. Yet the mainstream interpretation of Keynes has largely ignored the D/Z-analysis of Chapter 3, concentrating on Hicks's (1937) IS/LM-model instead (cf. King, 1994).[1] Even some influential post-Keynesians – like Lavoie (2003), for instance – have argued in favor of scrapping the D/Z-model so that it would become easier to recast Keynes's most valuable insights in models which are more amenable to a broader audience. Yet the D/Z-model has soldiered on; and it has even experienced a little 'renaissance' recently in the *Review of Political Economy* (ROPE), where the first two articles of the 2009 volume engage in D/Z-analysis (Allain, 2009, Palacio-Vera, 2009).

But have these two articles – taken together – really rendered a service to the D/Z-model? I would answer this question in the negative since what Allain and Palacio-Vera write about D and Z is inconsistent with one another. This will be demonstrated in the next section. If divergent or even contradictory interpretations of a model can co-exist in adjacent articles of the same journal, then Lavoie (2003) is probably right that such a model is too complicated or too opaque to be useful. However, neither Allain nor Palacio-Vera can of course be blamed for someone else offering an interpretation that departs from their own. Still, logic dictates that if two interpretations contradict each other, then at most one of them can correspond to the object of interpretation – in this case, Keynes's theory. Section 3 below will therefore confront Allain's and Palacio-Vera's interpretations of the D/Z-model with Keynes's own

writings in order to find out which of the two interpretations is more adequate. Section 4 concludes.

2. Allain and Palacio-Vera on D and Z

As a first step, let's take a look at the graphical representation of the D/Z-model given by Allain (2009) and Palacio-Vera (2009), respectively. Keynes does not draw any curves in Chapter 3 of the *General Theory*, so the shapes and positions of D and Z have to be inferred from his text. Figures 1 and 2 below are reproduced exactly as they appear in Allain's and Palacio-Vera's articles. If we compare them, we notice both similarities and differences. These are listed in Table 1.

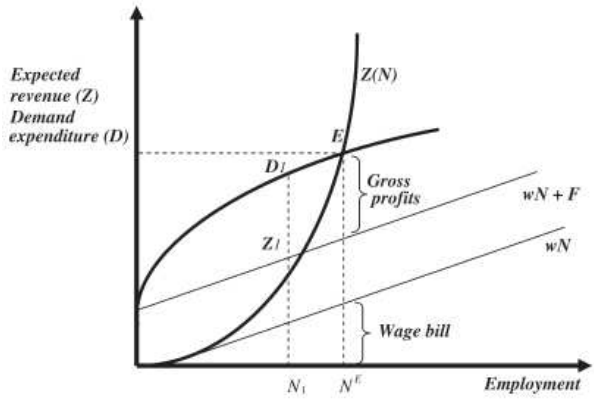

Figure 1. Keynes's aggregate supply and demand model (Palacio-Vera, 2009, p. 26)

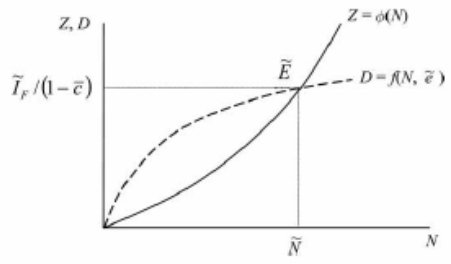

Figure 2. Aggregate supply and demand functions (Allain, 2009, p. 9)

Table 1. Similarities and differences between Figures 1 and 2

Similarities	Differences
• *Employment (N) is at the horizontal axis.*	• *The figures give different additional details, for instance the wage bill line in Figure 1.*
• *Z and D are at the vertical axis.*	• *Only Allain notes that D is a function of employment (plus a parameter $\tilde{e}$).*
• *Z is convex and a function of employment.*	• *Allain's D-curve goes through the origin, whereas Palacio-Vera's D-curve has the positive intercept 'F'.*
• *D is concave.*	

Now that we know how the curves look like, we can turn to the more important question of what they are supposed to signify. Here we have to distinguish between Allain's and Palacio-Vera's presentations.

Allain (2009) starts from a microeconomic perspective. He attributes to Keynes the notions of perfect competition, diminishing marginal returns and profit-maximizing firms.[2] These are the familiar (neo-) classical supply-side assumptions, from which the supply function of the representative firm – Allain calls it z_i – arises. z_i is the mathematical product of a price and the production quantity q_i of the representative firm. Production is a function of employment n_i (only). The price component implicit in z_i Allain (2009, p. 7) calls the 'expected unit price' p_i^e, but he makes clear that p_i^e is not a single price that entrepreneur *i* really expects for a unit of output for a given selling period but a range of conceivable prices which stem from profit maximization. The first-order condition resulting from profit maximization can be rewritten as:

$$\frac{w}{q_i'(n_i)} = p_i^e .^3$$

Therefore, with w given, p_i^e shows for each n_i the price that would maximize profits if it was expected. Which of the multitude of conceivable profit-maximizing prices *really is* expected, cannot be answered by looking at the z_i-function alone. The entrepreneur has to form an expectation concerning the price for his or her product the market will accept. Allain (2009, p. 7) denotes this price as $\tilde{p}_i^e$. $\tilde{p}_i^e$ is the price component implicit in the d_i-function, in other words, there is a different $\tilde{d}_i$-function for each $\tilde{p}_i^e$. Through intersecting with z_i, $\tilde{d}_i$ picks, so to speak, the 'right' p_i^e and corresponding n_i on the z_i-function.[4] Altogether, z_i can be written as:

$$z_i = \frac{w}{q_i'(n_i)} q_i(n_i) = \phi_i(n_i) .^5$$

The individual z_i-curves can be aggregated straightforwardly to yield the macroeconomic Z-curve (cf. Allain, 2009, p. 8 and already Davidson, 1962).

Allain's micro-perspective carries over to the demand side. The d_i-function has already been introduced. It shows the demand an entrepreneur expects for his or her output for the period ahead. Whereas the price implicit in z_i varies over n_i, the price implicit in d_i doesn't. What is important is that for Allain, d_i is something that the producers are concerned about, not the buyers. d_i is (nominal) demand for the output of an individual firm as expected by the entrepreneur. The individual d_i-functions can also be aggregated (summed) straightforwardly, according to Allain (2009, p. 9), which yields the macroeconomic 'aggregate demand function' D = f(N). Again, D shows aggregate demand as expected by the entrepreneurs for different levels of employment, hence the expectations parameter $\tilde{e}$ in Figure 2.

Allain (2009, p. 9) writes that the "concavity [of D] is derived from the decrease of marginal returns". This probably needs an explanation. It means that because of diminishing returns, the second derivative of the aggregate production function is negative (cf. Amadeo, 1989, p. 105). Therefore, the aggregate production function is concave in the output, employment space. Entrepreneurs will expect aggregate demand to grow in line with output (income) so that the 'real' component of D will have a negative second derivative with respect to N, too. This 'real' component has to be multiplied by the expected market (or 'demand') price level, which is constant for each D. Altogether, this results in a concave D-function.

The point of intersection of D and Z (point $\tilde{E}$ in Figure 2) gives the expected proceeds (on D) that are profit-maximizing (because they are also on Z). Therefore, the corresponding output quantity will be supplied, and employment will be at $\tilde{N}$.

Now let's compare this with Palacio-Vera's version. He writes (2009, p. 25):

> "(T)here will be a systematic relationship between the number of workers (N) that firms want to hire and the expected total volume of sales (Z). This relationship is called the *aggregate supply curve* and is drawn as the Z-curve in

> Figure 1. It is upward sloping because the more firms expect to sell, the larger the number of workers firms will want to hire."

Apparently, Palacio-Vera calls 'Z' what Allain calls 'D', namely expected proceeds. His statement resembles a production-function style argument: larger sales imply a larger production which means that more workers are needed. This seems to correspond to Allain's description of D as the output quantity valued at expected market prices. The differences between Allain and Palacio-Vera over Z may not be substantial, however. Shortly after his introduction of Z, Palacio-Vera quotes Vickers (1987), who makes it clear that Z describes, not expected proceeds, but "the total money proceeds that producers *must be able* to expect from the sale of output to make the employment of a designated number of workers economically worthwhile, or to provide profit maximization…" (Vickers, 1987, p. 87, emphasis added). This resembles more Allain's definition of Z as showing for each N the proceeds that would maximize profits if they were expected. We know that for Allain, D determines which of these notional profit-maximizing proceed levels is really expected. So what does D signify for Palacio-Vera? He writes (2009, p. 26):

> "(A)t any level of employment, the sum of expenditures by all these sectors [households, the government, foreigners, and firms] on goods and services produced domestically is called aggregate demand. … (W)e may assume that, in general, total spending grows as employment expands. As a result, the *aggregate demand curve* or D-curve is also upward sloping as in Figure 1."

Palacio-Vera makes it perfectly clear that, for him, the D-curve shows *actual* aggregate demand. There is no expectation-building involved. D is something the buyers decide on; it's actual expenditure, not expenditure as expected by the producers. Now while the differences between him and Allain concerning Z may be less important (although I think they still are, as I will argue in the next section), there can be no doubt that the two articles are inconsistent

with one another with respect to D. As will be remembered, Allain's 'aggregate demand function' shows entrepreneurs' demand expectations. He writes (2009, pp. 2-3):

> "On the one hand, the aggregate demand function (D) proceeds from the entrepreneurs who wonder about their outputs without any consideration for the macroeconomic level. On the other hand, the global expenditure function (E) takes into account, at the macroeconomic level, the propensity to consume and the inducement to invest. In this article, we show that these two functions cannot be combined into one unified function."

Clearly, Palacio-Vera's D-function is called 'E' by Allain, who sets himself the task to "prove that the latter [the E-function] cannot have a given shape in the Z, N space as it depends on money income rather than on employment (Allain, 2009, p. 5). So if Palacio-Vera's D-curve is impossible to draw in Allain's version of the D/Z-model, then we have a plain contradiction between the two articles. The question then arises which of the two versions of the D/Z-model – if any – can claim to be in line with Keynes's original contribution. The next section will try to answer this question.

3. Allain, Palacio-Vera, and Keynes

Keynes writes in Chapter 3 of the *General Theory* (Keynes, 1936, pp. 24-25):

> "(T)he aggregate supply price of the output of a given amount of employment is the expectation of proceeds which will just make it worth the while of the entrepreneur to give that employment. … Let Z be the aggregate supply price of the output from employing N men, the relationship between Z and N being written $Z = \phi(N)$, which can be called the *Aggregate Supply Function*. Similarly, let D be the proceeds which entrepreneurs expect to receive from the employment

> of N men, the relationship between D and N being written D = *f*(N), which can be called the *Aggregate Demand Function*."

Given that Keynes held profit-maximization to be the firm's objective,[6] the 'worth-while' employment must be the profit-maximizing employment. So for each N, the Z-function gives the proceeds that would maximize profits if they were expected. D gives the proceeds that the entrepreneurs really expect for each N. D does not give *actual* proceeds. Therefore, Palacio-Vera's version of the D/Z-model is not in line with Keynes's own presentation of it.[7]

The reason why Palacio-Vera's version of the D/Z-model is at odds with Keynes's own version can be found in the introduction to his paper. There he writes that he will introduce the D/Z-model – he calls it 'AS-AD model', which is unfortunate since this term is normally reserved for the well-known neoclassical synthesis model – "as elaborated by Weintraub and Davidson" (Palacio-Vera, 2009, p. 25). As I have argued in detail elsewhere (Hartwig, 2007), Sidney Weintraub and Paul Davidson – although they are to be lauded for having rescued the D/Z-model from oblivion – have in fact introduced the mis-interpretation of the D/Z-model that Palacio-Vera subscribes to. In short, this mis-interpretation consists in first mixing up Keynes's D and Z-curves into Z so that the latter not only shows the profit-maximizing proceeds for each N, but also the expected proceeds. This is tantamount to assuming that, despite competition, the entrepreneurs expect the customers to automatically spend the profit-maximizing sums at each N. Keynes's D-curve, thus discharged of content, is re-charged by contending that it signifies actual demand, although this contention has no textual basis in Chapter 3 of the *General Theory*.

Allain, for his part, remains true to Keynes's own depiction of Z as a benchmark that shows the notional profit-maximizing proceeds and of D as showing what entrepreneurs think customers really will spend. To illustrate the difference between the two approaches, we can take Palacio-Vera's (2009, p. 26) description of what happens at employment level N_1 in Figure 1. He writes that firms expect a sales level of Z_1, which is lower than actual demand D_1

so that firms are caught by surprise. They have produced too little and will increase their production level (probably during the next production period, although Palacio-Vera remains largely silent on dynamic aspects that are the main focus of Allain's contribution). In Allain's approach, the situation just described could not happen because firms always produce at point E (or $\tilde{E}$, respectively). As was mentioned, for Palacio-Vera *all* points on Z are both profit-maximizing and 'expected', whereas this is true for only one point ($\tilde{E}$) in Allain's interpretation of the D/Z-model. The latter interpretation is certainly more in line with Chapter 3 of the *General Theory* than the former.

This does not mean, however, that I agree with every aspect of Allain's account of the D/Z-model and principle of effective demand. Let's have another look at the individual firm's demand function (d_i), for instance. In his Figure 1, Allain draws d_i -curves as concave, just like their macroeconomic counterpart (D) that was reproduced above in Figure 2. But the question is why. The intuition that a constant demand price level multiplied by a production quantity that is subject to diminishing returns will yield a concave curve is correct for the macro level. But let's not forget that for the individual firm, the d_i -curve is supposed to show how much demand in money terms the entrepreneur can expect. The horizontal axis of the diagram is labeled n_i, which is the employment in his or her firm. So is the demand an entrepreneur can expect for his or her output really dependent on (a positive function of) the number of people he or she employs – as a concave d_i -curve would imply?[8] Probably not outside very large enterprises – Henry Ford is sometimes reported to have hired workers because their income would allow them to buy Ford cars. Therefore, Parrinello (1980, pp. 68-70) and Wells (1987, p. 512) draw the firm's D-curve (d_i) as a horizontal line. If it cannot be established that the firm's D-curve (d_i) is concave, it follows that Allain (2009, p. 9) is too rash to assert that the firms' curves can simply be summed to yield a concave macroeconomic D-curve. Also, he may be too rash to assert – as he does repeatedly (for instance also in the quote given above) – that "it is absolutely useless to assume that entrepreneurs form

expectations about the global expenditure of the economy; the assumption that they concentrate on their own affairs is amply sufficient" (Allain, 2009, p. 21). I think that this is the opposite of the truth. In Chapter 20 of the *General Theory*, Keynes (1936, p. 280) explicitly recognizes that the employment individual firms will give is a function of *total* effective demand. This is only natural. When an entrepreneur forms an expectation about how much demand will be forthcoming to his or her firm, he or she will have to consider whether times are good or bad for the overall economy. Therefore, the employment decision of individual firms will depend on total effective demand (which is an expected magnitude). In my earlier contributions (cf. fn. 4), I've tried to establish that when entrepreneurs relate employment in their own firms to expected overall employment, concave d_i -curves will emerge. These could then indeed be summed to yield a concave macroeconomic D-curve.

Recognizing that entrepreneurs do not 'concentrate on their own affairs' but are concerned with the state of the macro-economy also solves another problem of Allain's reconstruction of the D/Z-model: the missing intercept of D. In Chapter 3 of the *General Theory*, Keynes distinguishes between two components of D, which he calls D_1 and D_2. D_1 designates expected consumption demand and is, according to Keynes (1936, pp. 28-29) a function of employment ($\chi(N)$). Although he does not say it directly, from what he writes on p. 30 of the *General Theory* it is clear that Keynes regarded expected investment demand (D_2) *not* to be a function of employment (cf. also Chick, 1983, p. 67). This means that if we draw D_2 in the Z/D, N space of Figures 1 and 2, it should be a horizontal line – with the concave D_1-curve set on top of it.[9] The aggregate D-curve would thus look like Palacio-Vera's curve in Figure 1 – only that Palacio-Vera gives the wrong reasons for the positive intercept. For him, the intercept is not equal to expected investment expenditure but to firms' interest payments (F), which are fixed costs for them. This is so because Palacio-Vera mistakes D for showing, not expected, but actual expenditure which depends on income. Rentiers' income does not vary with employment, hence the intercept.

This concludes my critique of Allain's and Palacio-Vera's views of Keynes's D/Z-model. Yet there are two more issues that need to be discussed. The first issue concerns the definition of the term 'effective demand', which is not in line with Keynes's own definition in both ROPE contributions. As was mentioned in the introduction, Keynes calls the point of intersection of D and Z '*the effective demand*'. Since Z is a notional and D an expectational function, effective demand is so to speak an expectational equilibrium. The D/Z-model is designed to explain how, under conditions of uncertainty, entrepreneurs arrive at their decision how much to produce and how many workers to employ. It's a model of supply, rather than demand. Therefore, Victoria Chick (1983, p. 65) was right to point out: "Effective demand is an unfortunate term, for it really refers to the output that will be *supplied*; in general there is no assurance that it will also be demanded." Palacio-Vera (2009, p. 27), on the other hand, thinks that "the point of effective demand represents an equilibrium level of spending where firms' expectations are just being fulfilled …" That's precisely wrong. Entrepreneurs' expectation formation under uncertainty could rather lead to a level of supply that deviates from customers' demand. Allain's main concern is the adjustment process that sets in in such a situation. Given that his re-interpretation of the D/Z-model is largely correct, it is curious that his definition of effective demand isn't. He uses the term more in the sense of 'actual demand', as is evidenced by the aim he sets himself for his paper, namely to "verify that *The General Theory* provides a coherent framework to analyse the short-term dynamics … which lead entrepreneurs to produce the level of output consistent with effective demand" (Allain, 2009, p. 4). In Keynes's sense of the term, 'effective demand' is *always* consistent with the level of output.

The second and final issue concerns Palacio-Vera's re-interpretation of Keynes's production function. I fully agree with Palacio-Vera that the concept of an aggregate production function is an important tenet of Keynes's macro-theory, despite the fact that there are passages in the *General Theory* (for instance on pp. 38-40) where Keynes seems to

dismiss the concept.[10] However, Keynes nowhere in the *General Theory* uses the production function with two variable inputs (labor and capital) Palacio-Vera proposes. Instead, Keynes strictly adheres to the marginal productivity theory of one fixed factor (capital) and one variable factor (labor), and – unlike in Palacio-Vera's article – every single application of the differential calculus in the *General Theory* refers to a total derivative, not a partial derivative. Authors such as Brady (1994a, 1994b, 1995), Hartwig (2000), and Ambrosi (2003, 2008) have argued that Keynes's adoption of the marginal productivity theory with fixed capital and variable labor was part of a research strategy in which Keynes aimed at modeling the supply side of the economy the same way as Pigou (1933), who was the then leading (neo-) classical theorist. By doing so, Keynes could direct the readers' attention towards the demand-side differences between him and the 'classics'. Several passages in the *General Theory* support this view, for instance Keynes (1936, p. 89), and the appendix to Chapter 19. Whether one chooses to stick to Keynes's production function with one variable factor or to allow for two variable factors can have severe consequences for the interpretation of the *General Theory*, as the controversy between Hayes (2007, 2008) and Hartwig and Brady (2008) has shown.

4. Conclusion

The aim of this paper it is to resolve contradictions between two articles recently published in the *Review of Political Economy* concerning Keynes's D/Z-model and principle of effective demand. Since the tenor of the paper has been rather critical, it is apposite to conclude by summarizing what I believe to be the major merits of the two articles.

First, apart from a couple of squabbles, I basically agree with Allain's (2009) re-interpretation of Chapter 3 of the *General Theory*, especially with his emphasis that D refers to demand *expectations* of entrepreneurs which normally will not be met in reality. His analysis of the short-term adjustment dynamics in case of unfulfilled expectations and his insight that – contrary to the familiar Keynesian 'quantity reactions' – it's either the price

level or the stock of inventories that does the adjustment job resonates well with my own earlier attempts to clarify these issues (particularly Hartwig, 2004a, 2006).

Second, Palacio-Vera's (2009) contribution is an interesting effort to advance the Weintraub-Davidson line of interpreting the principle of effective demand. The results of his technically challenging comparative static analysis seem plausible to me, yet – and this I would underline – this analysis has much less reason to refer to Keynes than Palacio-Vera claims.

References

Allain, O. (2009) Effective demand and short-term adjustments in the General Theory, *Review of Political Economy*, 21, pp. 1-22.

Amadeo, E. J. (1989) *Keynes's Principle of Effective Demand* (Aldershot, Edward Elgar).

Ambrosi, G. M. (2003) *Keynes, Pigou and Cambridge Keynesians. Authenticity and Analytical Perspective in the Keynes-Classics Debate* (Basingstoke, Palgrave Macmillan).

Ambrosi, G. M. (2008) Keynes, Pigou, and the General Theory, *mimeo*.

Brady, M. E. (1994a) A note on the Keynes-Pigou controversy, *History of Political Economy*, 26, pp. 697-705.

Brady, M. E. (1994b) Keynes, Pigou and the supply side of the General Theory, *History of Economics Review*, 21, pp. 34-46.

Brady, M. E. (1995) A study of J. M. Keynes' Marshallian-Pigouvian elasticity approach in Chapter 20 and 21 of the GT, *History of Economics Review*, 24, pp. 55-71.

Casarosa, C. (1981) The microfoundations of Keynes's aggregate supply and expected demand analysis, *Economic Journal*, 91, pp. 188-194.

Chick, V. (1983) *Macroeconomics after Keynes: a Reconsideration of the General Theory* (Oxford, Philip Allan).

Davidson, P. (1962) More on the aggregate supply function, *Economic Journal*, 72, pp. 452-457.

Hartwig, J. (2000) *Keynes versus Pigou. Rekonstruktion einer Beschäftigungstheorie jenseits des Marktparadigmas* (Marburg, Metropolis).

Hartwig, J. (2004a) Keynes's multiplier in a two-sectoral framework, *Review of Political Economy*, 16, pp. 309-334.

Hartwig, J. (2004b) Beyond the market paradigm: On Keynes's principle of effective demand, and on the irrelevance of rigidities for his explanation of involuntary unemployment, *History of Economic Ideas*, 12, pp. 67-94.

Hartwig, J. (2006) Explaining the aggregate price level with Keynes's principle of effective demand, *Review of Social Economy*, 64, pp. 469-492.

Hartwig, J. (2007) Keynes vs. the Post Keynesians on the principle of effective demand, *European Journal of the History of Economic Thought*, 14, pp. 725-739.

Hartwig, J. (2008) Three views of the multiplier, in: C. Gnos and L.-P. Rochon (Eds) *The Keynesian Multiplier* (London, Routledge).

Hartwig, J. and Brady, M. E. (2008) Comment: Hayes on Z, *Cambridge Journal of Economics*, 32, pp. 815-819.

Hayes, M. G. (2007) Keynes's Z function, heterogeneous output and marginal productivity, *Cambridge Journal of Economics*, 31, pp. 741-753.

Hayes, M. G. (2008) Keynes's Z function: a reply to Hartwig and Brady, *Cambridge Journal of Economics*, 32, pp. 811-814.

Hicks, J. R. (1937) Mr. Keynes and the Classics: A suggested interpretation, *Econometrica*, 5, pp. 147-159.

Keynes, J. M. (1936) *The General Theory of Employment, Interest, and Money* (London, Macmillan).

King, J. E. (1994) Aggregate supply and demand analysis since Keynes: A partial history, *Journal of Post Keynesian Economics*, 17, pp. 3-31.

Koenig, G. (1980) Les fondements microéconomiques du principe de la demande effective, *Revue Economique*, 31, pp. 430-464.

Lavoie, M. (2003) Real wages and unemployment with effective and notional demand for labor, *Review of Radical Political Economics*, 35, pp. 166-182.

Palacio-Vera, A. (2009) Capital accumulation, technical progress and labour supply growth: Keynes's approach to aggregate supply and demand analysis revisited, *Review of Political Economy*, 21, pp. 23-49.

Palley, T. I. (1997) Expected aggregate demand, the production period and the Keynesian theory of aggregate supply, *The Manchester School*, 65, pp. 295-309.

Parrinello, S. (1980) The price level implicit in Keynes' effective demand, *Journal of Post Keynesian Economics*, 3, pp. 63-78.

Pigou, A. C. (1933) *The Theory of Unemployment* (London, Macmillan).

Roberts, D. L. (1978) Patinkin, Keynes, and aggregate supply and demand analysis, *History of Political Economy*, 10, pp. 549-576.

Vickers, D. (1987) Aggregate supply and the producer's expected demand curve: performance and change in the macroeconomy, *Journal of Post Keynesian Economics*, 10, pp. 84-104.

Wells, P. (1987) Keynes's employment function and the marginal productivity of labor, *Journal of Post Keynesian Economics*, 9, pp. 507-515.

Footnotes

[1] Hicks originally called the two curves SI and LL, but the notation IS/LM eventually became accepted.

[2] This is slightly off the mark. Although it is true that Keynes's acceptance of the 'first classical postulate' (Keynes, 1936, pp. 17-18) implies the adoption of the neo-classical supply-side assumptions of price-taking, profit-maximization, and decreasing marginal returns to labor (cf., among others, Roberts, 1978, Koenig, 1980, Amadeo, 1989, and Palley, 1997), 'perfect competition' goes beyond this to imply firms facing perfectly elastic demand. In fact, to insinuate that Keynes assumed perfectly elastic demand would contradict the idea of entrepreneurs forming ex ante expectations concerning demand, but this is an idea that Allain defends (see below). Curiously enough, Casarosa (1981) – whom Allain includes in his list of references – points this out. It is more to the point to attribute to Keynes the more flexible (Marshallian) concept of 'free competition' instead of perfect competition.

[3] Allain's (2009, p. 7) notation. w = money wage rate. (The other symbols have already been introduced.)

[4] I have argued repeatedly (Hartwig, 2000, 2004a, 2004b, 2006, 2007) that it would have been clearer if Keynes (1936, pp. 24-5) had called the price component inherent in the Z curve the 'supply price' – and had made clear that it is the *notional* profit-maximizing price – and the price component inherent in the D curve the 'demand price' – and had made clear that this is the price that entrepreneurs really expect. The use of the word 'expected' by Keynes for both prices has produced confusion.

[5] Allain (2009), in his Figure 1, draws the z_i curve as convex just like its macroeconomic counterpart Z that was reproduced above in Figure 2. He does not substantiate the convex form of the z_i curve, however. Davidson (1962) shows that z_i may be linear, even under diminishing returns, depending on the production function (cf. also Vickers, 1987). To establish the convex form of z_i (and Z), one has to make additional assumptions, for instance that the profit share rises with employment.

[6] "(E)ntrepreneurs will endeavor to fix the amount of employment at the level which they expect to maximise the excess of the proceeds over the factor cost" (Keynes, 1936, pp. 24-25).

[7] Curiously enough, Palacio-Vera repeatedly cites Vickers (1987), who distinguishes sharply between the 'producers' expected demand curve' and the 'aggregate demand curve'.

[8] To make this plain: the d_i -curve is not a production function. It is not supposed to depict that more people are needed to produce more output. The concavity of the *macro* D-curve has been established by assuming that aggregate demand can be expected to grow in line with aggregate production. This assumption is unwarranted for the firm level. A firm can hire a lot of people and produce a lot of output only to learn that there is no

demand for that output. That's exactly the reason why the entrepreneur tries to estimate ex ante how much demand might be forthcoming. This demand expectation (d_i) is not a function of the employment in his or her own firm.

[9] It's the entrepreneurs in the consumption-goods sector who have to form expectations about the level of investment spending in order to calculate how much demand will be forthcoming to them through the multiplier mechanism (cf. Hartwig, 2004a, 2006, 2008).

[10] Whether Keynes regarded the concept of aggregate output as admissible has recently been at issue between Hayes (2007, 2008) and Hartwig and Brady (2008).