A note on the second linearity critique

Pietro F. Peretto*

Department of Economics, Duke University

January 18, 2016

The purpose of this note is to further clarify the issue mentioned in Peretto (2016), providing detail that does not belong in the paper but that might nevertheless be useful to fully appreciate the debate.

As I say in the paper, there is a second linearity or knife-edge or razor-edge critique. First popularized in a short review article by Jones (1999), and further elaborated in Jones (2005), it consists of the claim that to sterilize the (strong) scale effect the models proposed by Dinopoulos-Thompson (1998), Peretto (1998), Young (1998), and Howitt (1999), assume that the mass of products/firms, N, is exactly proportional to population size, L. The reality is rather different.

1) The mentioned articles do not *assume* that N is proportional to L but obtain such proportionality as an equilibrium relationship.

2) The mentioned articles obtain N exactly proportional to L because of specific simplifying assumptions (on price-cost markups, the structure of spillovers and so on); there are many other contributions that do not use those simplifying assumptions and obtain relationships between N and L that are much richer and definitely not proportionality. See, e.g., Peretto (1994, 1996, 1998a, 1999a,b), Smulders (1994), Smulders-van De Klundert (1995, 1996), Peretto-Smulders (2002). The interested reader might notice that many of these papers were already published by the time the second linearity critique was popularized in 1999.

3) The list of contributions that find N not proportional to L is getting longer as people keep working on these ideas, experimenting with different assumptions and functional forms.

4) Ultimately, however, the final arbiter is empirical evidence — which is clearly in favor of this class of models. For examples, see Zachariadis (2003), Laincz and Peretto (2006), Ha and Howitt (2007), Ulku (2007), Madsen (2008, 2010), Madsen and Ang (2011), Madsen, Ang and Banerjee (2011), Greasely et al. (2013), and, most recently, Bollard, Klenow and Li (2014).

*Address: Department of Economics, Duke University, Durham, NC 27708. Phone: (919) 6601807. Fax: (919) 6848974. E-mail: peretto@econ.duke.edu

5) Indeed, the most striking feature of the data is how hard it is to reject the hypothesis that N is proportional to L.

Scientifically, therefore, despite its rethorical flair, the second linearity critique fails twice. First, it fails because it is a grossly inaccurate characterization of the theory it claims to describe. Second, it fails because it is empirically irrelevant: the evidence does not reject that to a first approximation N is proportional to L.

References

[1] Bollard, A., Klenow P.J., and Li H., 2014, Entry costs rise with development, manuscript, Stanford University.

[2] Dinopoulos, E., and Thompson, P., 1998, Schumpeterian growth without scale effects, *Journal of Economic Growth*, 3(4): 313-335.

[3] Ha, J., and Howitt, P., 2007, Accounting for trends in productivity and R&D: A Schumpeterian Critique of Semi-Endogenous Growth Theory, *Journal of Money, Credit, and Banking*, 33: 733-74.

[4] Howitt P., 1999, Steady Endogenous Growth with Population and R&D Inputs Growing, *Journal of Political Economy*, 107: 715-730.

[5] Jones, C.I., 1999, Growth: With or Without Scale Effects?, *American Economic Review P&P*, 89(2): 139-144.

[6] Jones, C.I., 2005, Growth and Ideas, in: Philippe Aghion & Steven Durlauf (ed.), *Handbook of Economic Growth*, edition 1, volume 1, chapter 16, pages 1063-1111. Elsevier.

[7] Laincz, C., and Peretto, P.F., 2006, Scale effects in endogenous growth theory: An error of aggregation, not specification, *Journal of Economic Growth,* 11: 263-288.

[8] Greasley, D., Jakob B. Madsen, J.B., and Wohar, M.E., 2013, Long-run growth empirics and new challenges for unified theory, *Applied Economics*, 45(28): 3973-3987.

[9] Madsen, J. B., 2008, Semi-endogenous versus Schumpeterian growth models: Testing the knowledge production function using international data, *Journal of Economic Growth*, 13: 1-26.

[10] Madsen, J.B., 2010. The anatomy of growth in the OECD since 1870: The transformation from the post-Malthusian growth regime to the modern growth epoch, *Journal of Monetary Economics*, 57: 753-767.

[11] Madsen, J.B., Ang, J.B., and Banerjee, R., 2010, Four centuries of British economic growth: the roles of technology and population, *Journal of Economic Growth*, 15: 263-290.

[12] Madsen, J.B., Saxena, S., and Ang, J.B., 2010, The Indian growth miracle and endogenous growth, *Journal of Development Economics*, 93(1): 37-48.

[13] Madsen, J.B., and Ang, J.B., 2011, Can Second-Generation Endogenous Growth Models Explain the Productivity Trends and Knowledge Production in the Asian Miracle Economies?, *The Review of Economics and Statistics*, 93(4): 1360-1373.

[14] Madsen, J.B., and Ang, J.B., 2013, The Asian Growth Miracle: Factor Accumulation, The Demographic Transition And R&D-Driven Growth, Monash Economics Working Papers 23-13, Monash University, Department of Economics.

[15] Madsen, J., and Timol, I., 2011, Long-Run Convergence in Manufacturing and Innovation-Based Models, *The Review of Economics and Statistics*, 93(4): 1155-1171.

[16] Peretto, P.F., 1994, *Essays on Market Structure and Economic Growth*, Ph. D. Dissertation, Yale University, New Haven, CT (USA).

[17] Peretto, P.F., 1996, Sunk Costs, Market Structure and Growth, *International Economic Review*, 37(4), 895-923.

[18] Peretto, P. F., 1998a, Technological change, market rivalry, and the evolution of the capitalist engine of growth, *Journal of Economic Growth*, 3: 53-80.

[19] Peretto, P.F., 1998b, Technological Change and Population Growth. *Journal of Economic Growth* 3(4): 283-311.

[20] Peretto, P. F., 1999, Cost reduction, entry, and the interdependence of market structure and economic growth, *Journal of Monetary Economics*, 43: 173-195.

[21] Peretto, P.F., Connolly, M., 2007, The Manhattan Metaphor, *Journal of Economic Growth*, 12(4): 329-350.

[22] Peretto, P.F., 2013, From Smith to Schumpeter: A Theory of Take-off and Convergence to Sustained Growth, *European Economic Review*, 78, 1-26.

[23] Peretto, P.F., and Smulders, S., 2002, Technological Distance, Growth And Scale Effects, *Economic Journal* 112 (481): 603-624.

[24] Smulders, S., 1994, *Growth, market structure and the environment: Essays on the theory of endogenous economic growth*, Ph. D. Dissertation, Tilburg University, Tilburg, The Netherlands.

[25] Smulders, S. and van de Klundert T., 1995, Imperfect Competition, Concentration and Growth with Firm-Specific R&D, *European Economic Review*, 39: 139-160.

[26] Ulku, H., 2007, R&D, Innovation, and Growth: Evidence from Four Manufacturing Sectors in OECD Countries, *Oxford Economic Papers*, 59: 513-535.

[27] Zachariadis, M., 2003, R&D, innovation, and technological progress: a test of the Schumpeterian framework without scale effects, *Canadian Journal of Economics*, 36(3): 566-586.