
Business Cycles and International Trade

Harald Uhlig

University of Chicago

My essay will examine two rather separate topics, though there is a bit of a connection. One concerns business cycles. The other concerns international trade and exchange rates. With all due apologies and very few exceptions, I shall focus on the most highly cited papers published in the *Journal of Political Economy*.

Business Cycles

The 1970s and early 1980s saw a revolution in our thinking about macroeconomics generally and business cycles specifically. Central to this de-

velopment was a revolutionary paradigm shift in how the expectations of agents regarding the future should be taken into account in their current choices, notably for consumption, mostly insisting that these expectations should be rational and agree with the formulation of probability theory. Before that revolution, it was customary to assume a consumption function, according to which aggregate consumption rises in somewhat less than a proportional manner and according to the marginal propensity to consume, when current aggregate income rises, regardless of concerns about developments of these incomes in the future. That older paradigm is still remarkably alive in quite a number of undergraduate textbooks on macroeconomics and policy discussions, but it has been entirely upended by the rational expectations revolution as far as the scientific analysis and thinking about business cycles and other economic phenomena are concerned: only in special cases then does the old paradigm still work. From the beginning and in particular in the work by Sargent, the hypothesis of rational expectations was connected to the issue of how rational expectations or other forms of expectations can be learned (see Uhlig 2012a).

Perhaps the most seminal contribution in this (then) new thinking about consumption is the paper by Lucas (1978). He examined the optimization problem of an agent with time-separable preferences, who can freely trade assets with stochastic returns R_{t+1} in period t on one unit of resources invested at t . He derived what is now typically referred to as the Lucas asset pricing equation:

$$1 = E_t[M_{t+1} R_{t+1}], \quad \text{where } M_{t+1} = \beta \frac{u'(c_{t+1})}{u'(c_t)},$$

where $u'(c_t)$ is the period t felicity for an agent, consuming c_t ; β is the discount factor; E_t denotes the conditional expectation, given all available information at time t ; and M_{t+1} is the resulting stochastic discount factor. The first part of the equation also holds for far more general preference formulations and has given rise to a substantial literature on asset pricing, as other essays in this issue discuss.

Here I shall focus on the macroeconomic implications and (mostly) keep to the separable formulation. Assuming $R_{t+1} = 1 + r$ to be a constant and safe return, it then follows that detrended marginal utility $[\beta(1 + r)]^t u'(c_t)$ is a random walk. If, moreover, utility is quadratic, then consumption likewise detrended is itself a random walk with drift. These are the celebrated results in Hall (1978), who writes that therefore “consumption is unrelated to *any* economic variable that is observed in earlier periods. In particular, lagged income should have no explanatory power with respect to consumption” (972). Hall proceeds to test and to then confirm these permanent-income predictions of the theory, while Sar-

gent (1978) instead obtains a rather decisive rejection. Flavin (1981) reconciles these two apparently conflicting findings. She rejects the joint rational expectations–permanent income hypothesis and finds that consumption exhibits excess sensitivity to current income.

For that exercise, it is ultimately crucial to estimate the revision in permanent income and the persistent reaction of income due to current news. Cochrane (1988) estimates the permanent reaction to be fairly small. The literature on persistence, unit roots, and cointegration since then has grown to impressive size.

Hall (1988) assumes that $u(c) = c^{1-1/\sigma}$ so that σ is the intertemporal elasticity of substitution: a popular specification in much of macroeconomics. Exploiting time variation in R_{t+1} , he calculates various estimates of σ and generally finds them to be small, near zero, or even negative. The macroeconomic literature since then has tended to assume σ to be between 0.5 and 1, and sometimes as low as 0.2, as well as allowed for extensions such as habit formation and borrowing-constrained or hand-to-mouth consumers. That literature furthermore typically assumes the log of total factor productivity (TFP) to exhibit short-run fluctuations around a time trend or to be a random walk with drift. These are then ingredients for building more substantial business cycle models.

The revolution in thinking about business cycles was to view them as equilibrium phenomena, where agents optimally react to shocks and policy changes, utilizing rational expectations. The program was laid out in Lucas (1975), though that paper did not yet feature preference-based optimizing behavior of agents. The program was completed in particular in the seminal contribution of Kydland and Prescott (1982), extending the stochastic neoclassical growth theory and giving rise to real business cycle theory. The contribution by Long and Plosser (1983) allows for a rich industry structure: a theme that recently has received considerable renewed attention in the production-network-based analysis of macroeconomic fluctuations. Real business cycle theory postulates that aggregate fluctuations are driven by exogenous fluctuations in TFP rather than, say, exogenous fluctuations in “aggregate demand” (which now would need to be derived from exogenous fluctuations in preference parameters) or policy. Prices and wages are assumed to be flexible and markets are assumed to clear. Many now dismiss such flexibility out of hand as unrealistic, and the literature has since moved to typically imposing a range of other frictions. Then again, one may argue that “reality” provides a better rationale in its favor than may be apparent at first (see Uhlig 2012b).

The real business cycle paradigm has since been extended and critically examined in a variety of ways. Backus, Kehoe, and Kydland (1992) extend the paradigm to the international realm, providing a connection

between the two sections here. Empirically, Hamilton (1983) argues that oil prices provide a substantial source of aggregate fluctuations, with Mork (1989) arguing that the effect is asymmetric and much stronger for oil price increases than oil price decreases. Basu and Fernald (1997) is an important paper, examining the intricacies of measuring the exogenous component of TFP and the challenges in utilizing it as a driving force. More recent versions of business cycle theories enrich them with a considerably larger set of shocks and frictions. In particular, the assumption of sticky prices is appealing to many and has become a standard ingredient of most of the business cycle analysis in the recent decade or so. One important example is the framework by Christiano, Eichenbaum, and Evans (2005), which, together with the related Smets and Wouters (2003) model, has become the blueprint for many workhorse models used in central banks around the world for policy analysis. In the wake of the financial crisis of 2008, these models have recently become extended by paying greater attention to financial intermediation and the role of the financial frictions more generally. At its core, all these models still feature a real business cycle engine, albeit modified and extended in considerable ways.

International Trade and Exchange Rates

Balassa (1964) together with Samuelson (1964) is the classic source for the well-known Balassa-Samuelson effect, that the purchasing power parity or consumer price level is higher in richer countries.

Dornbusch (1976) develops his classic exchange rate overshooting result for exchange rates. He assumes perfect foresight: the companion to rational expectations, if there are no further stochastic disturbances in the future. He considers a monetary expansion in a model of perfect capital mobility and slow adjustments of goods markets. He demonstrates that the initial and immediate depreciation of the exchange rate is then followed by a gradual appreciation of the exchange rate, to compensate for the ensuing inflation differential. Lothian and Taylor (1996) use unit root econometric methods, freshly developed in the decade prior to the publication of their paper, and demonstrate that the dollar-sterling and the franc-sterling real exchange rates are stationary, an important issue for the construction of international trade models.

The study of international trade and exchange rates has undergone profound paradigm shifts in the last few decades. It has incorporated the macroeconomic paradigm shift toward rational expectations and general equilibrium analysis described in the first section. The new trade theory furthermore views trade as arising from imperfect competition between possibly multinational firms, each producing its own variety.

Helpman (1984) provides a simple theory of international trade with multinational corporations, building on then-recent advances in analyz-

ing vertical integration and international trade in differentiated products. For production of a specific variety, he distinguishes between a general-purpose input possibly produced elsewhere, such as management, distribution and product-specific R&D, and local labor. Multinational corporations with entrepreneurial centers and subsidiaries together with their location decision then arise endogenously, explaining the simultaneous existence of intersectoral trade, intraindustry trade, and intrafirm trade. More recently, Antràs and Helpman (2004) examine the issue of global sourcing and the choice of organizational form for firms in international trade and relate sectoral productivity dispersion and headquarter intensity to the degree of integration and input imports.

Backus et al. (1992) have extended the real business analysis described in the previous section to a two-country setting. While they do not feature firm heterogeneity or sticky prices, they emphasize in particular the role of the capital stock and capital investment. More recent trade models often abstract from physical capital accumulation, though it may remain fruitful to include such forces as well.

Obstfeld and Rogoff (1995) critically reexamine the Dornbusch overshooting result as well as a number of other classic predictions in a new two-country model. Their model marries global macroeconomic dynamics to a supply framework based on monopolistic competition and sticky nominal prices, thereby providing novel insights into the dynamics of exchange rates and current accounts. It has become a benchmark and workhorse model in this field of inquiry. The latest generation of international trade models builds on the seminal contributions of Eaton and Kortum (2002) and Melitz (2003), focusing on matters such as firm entry and exit as well as trade costs, which the *JPE* unfortunately missed out on publishing: at least Samuel Kortum was on the faculty at the University of Chicago for a number of years. The field has been moving forward quickly in recent years, and these developments will be exciting to watch or to participate in.

References

- Antràs, Pol, and Elhanan Helpman. 2004. "Global Sourcing." *J.P.E.* 112 (3): 552–80.
- Backus, David K., Patrick J. Kehoe, and Finn E. Kydland. 1992. "International Real Business Cycles." *J.P.E.* 100 (August): 745–75.
- Balassa, Bela. 1964. "The Purchasing-Power Parity Doctrine: A Reappraisal." *J.P.E.* 72 (December): 584–96.
- Basu, Susanto, and John G. Fernald. 1997. "Returns to Scale in U.S. Production: Estimates and Implications." *J.P.E.* 105 (April): 249–83.
- Christiano, Lawrence J., Martin Eichenbaum, and Charles L. Evans. 2005. "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy." *J.P.E.* 113 (February): 1–45.

- Cochrane, John H. 1988. "How Big Is the Random Walk in GNP?" *J.P.E.* 96 (October): 893–920.
- Dornbusch, Rudiger. 1976. "Expectations and Exchange Rate Dynamics." *J.P.E.* 84 (December): 1161–76.
- Eaton, Jonathan, and Samuel Kortum. 2002. "Technology, Geography, and Trade." *Econometrica* 70 (5): 1741–79.
- Flavin, Marjorie A. 1981. "The Adjustment of Consumption to Changing Expectations about Future Income." *J.P.E.* 89 (October): 974–1009.
- Hall, Robert E. 1978. "Stochastic Implications of the Life Cycle–Permanent Income Hypothesis: Theory and Evidence." *J.P.E.* 86 (December): 971–87.
- . 1988. "Intertemporal Substitution in Consumption." *J.P.E.* 96 (April): 339–57.
- Hamilton, James D. 1983. "Oil and the Macroeconomy since World War II." *J.P.E.* 91 (April): 228–48.
- Helpman, Elhanan. 1984. "A Simple Theory of International Trade with Multinational Corporations." *J.P.E.* 92 (June): 451–71.
- Kydland, Finn E., and Edward C. Prescott. 1982. "Time to Build and Aggregate Fluctuations." *Econometrica* 50:1345–70.
- Long, John B., and Charles I. Plosser. 1983. "Real Business Cycles." *J.P.E.* 91 (February): 39–69.
- Lothian, James R., and Mark P. Taylor. 1996. "Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries." *J.P.E.* 104 (June): 488–509.
- Lucas, Robert E., Jr. 1975. "An Equilibrium Model of the Business Cycle." *J.P.E.* 83 (December): 1113–44.
- . 1978. "Asset Prices in an Exchange Economy." *Econometrica* 46 (6): 1429–45.
- Melitz, Marc J. 2003. "The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71:1695–1725.
- Mork, Knut Anton. 1989. "Oil and the Macroeconomy When Prices Go Up and Down: An Extension of Hamilton's Results." *J.P.E.* 97 (June): 740–44.
- Obstfeld, Maurice, and Kenneth Rogoff. 1995. "Exchange Rate Dynamics Redux." *J.P.E.* 103 (June): 624–60.
- Samuelson, Paul A. 1964. "Theoretical Notes on Trade Problems." *Rev. Econ. and Statis.* 46 (2): 145–54.
- Sargent, Thomas J. 1978. "Rational Expectations, Econometric Exogeneity, and Consumption." *J.P.E.* 86 (August): 673–700.
- Smets, Frank, and Raf Wouters. 2003. "An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area." *J. European Econ. Assoc.* 1 (5): 1123–75.
- Uhlig, Harald. 2012a. "Agents as Empirical Macroeconomists: Thomas J. Sargent's Contribution to Economics." *Scandinavian J. Econ.* 114 (December): 1055–81.
- . 2012b. "Economics and Reality." *J. Macroeconomics* 34:29–41.