New Open Economy Macroeconomics[1]

Giancarlo Corsetti
European University Institute
University of Rome III
Centre for Economic Policy Research

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Abstract

Starting in the early 1990s, the New Open Economy Macroeconomics refers to a vast body of literature embracing a new theoretical framework for policy analysis in open economy, with the goal of overcoming the limitations of the Mundell-Fleming model, while preserving the empirical wisdom and policy friendliness of traditional analysis. Building general equilibrium models with imperfect competition and nominal rigidities, the NOEM literature has reconsidered conventional views on the transmission of monetary and exchange rate shocks; it has contributed to the design of optimal stabilization policies, identifying international dimensions of optimal monetary policy and raising issues in the desirability of international policy coordination.

Introduction

The New Open Economy Macroeconomics (henceforth NOEM) is a leading development in international economics starting in the early 1990s. Its objective is to provide a new theoretical framework for open economy analysis and policy design, overcoming the limitations of the Mundell-Fleming model, while preserving the empirical wisdom and the close connection to policy debates of the traditional literature. The new framework consists of choice-theoretic, general-equilibrium models featuring nominal rigidities and imperfect competition in the goods and/or the labour markets. In this respect, the NOEM has tight links with related agendas pursued in closed-economy macro, such as the 'new neoclassical synthesis' and the 'neo-Wicksellian' monetary economics. Modelling imperfect competition is logically consistent with the maintained hypothesis that the optimal choice of prices and wages by firms be constrained by nominal frictions, as well as with the idea that output is demand-determined over some range, in which firms can meet demand at non-negative profits. On the other hand, general-equilibrium analysis paves the way towards further integration of international economics as a unified field, bridging the traditional gap between open macro and trade theory.

From a historical perspective, NOEM was launched by Obstfeld and Rogoff (1995), although Svensson and Van Wijnbergen (1989) had also worked out a model with NOEM features as an open economy development of Blanchard and Kiyotaki (1987).

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A specific goal of the NOEM agenda consists of achieving the standards of tractability which made traditional models so popular and long-lived among academics and policy makers. For instance, many contributions have adopted the model specification by Corsetti and Pesenti (2001), which admits a closed-form solution by virtue of some educated restrictions on preferences (Tille 2001 explains the relation of this model with Obstfeld and Rogoff 1995). At the same time, the NOEM literature has motivated the construction of a new generation of large, multi-country quantitative models by international institutions and national monetary authorities. A leading example is the Global Economic Model (GEM) of the International Monetary Fund (see e.g. Laxton and Pesenti 2003).

The following text first introduces a stylized NOEM model. Based on this model, it then provides a short selective survey of the NOEM literature, and its main advances in the analysis of the international transmission mechanism and policy design in open economies.

1. A stylized NOEM model

Taking full advantage of the theoretical insights from modern dynamic macroeconomics, the NOEM model differs from the Mundell-Fleming approach, in that all agents are optimizing, i.e. households maximize expected utility and managers maximize firms' value. The expected utility of the national representative consumer provides a natural welfare criterion to carry out policy evaluation and design.

To illustrate the basic features of NOEM models, highlighting similarities and differences with the Mundell-Fleming model, it is useful to refer to the model by Corsetti and Pesenti (2001, 2005a,b) and Obstfeld and Rogoff (2000), henceforth CP-OR. The economy consists of two countries, Home and Foreign, specialized in the production of a type of tradable goods, denoted H and F, respectively. Total Home consumption C combines local goods and imports, i.e. $C=C(C_H, C_F)$; the price level P includes both local goods and imports prices in Home currency, i.e. $P=P(P_H, P_F)$. Preferences over local and imported goods are Cobb-Douglas with identical weights across countries: as the elasticity of substitution is equal to one, any increase in domestic output is matched by a proportional fall in its price, so that terms of trade movements ensure efficient risk sharing. Furthermore, utility from consumption is assumed to be logarithmic, disutility from labour ℓ is linear.

Let μ index the Home monetary stance. Precisely, μ is the nominal value of the inverse of consumption marginal utility, e.g. with log utility, $\mu=PC$. Whatever the instruments used by monetary authorities, μ indexes its ultimate effect on current spending. With competitive labour markets, the Households' optimality conditions imply that the nominal wage moves proportionally to μ, i.e. $W=\mu$. Furthermore, abstracting from investment and government spending, μ indexes nominal aggregate demand. Similar definitions and conditions hold for the Foreign country, whose variables are denoted with a star, i.e. $\mu^*=W^*$.

Let ε denote the nominal exchange rate, measured in units of Home currency per unit of Foreign currency. With perfect risk sharing, it is well known that the real exchange rate $\varepsilon P/P^*$ is equal to the ratio between the consumption marginal utilities (see Backus and Smith 1993). Rearranging this condition, the nominal exchange rate is equal to the ratio of Home to Foreign monetary stance, i.e. $\varepsilon = \mu/\mu^*$. A Home expansion depreciates ε.

The equilibrium allocation can be characterized in terms of three equilibrium relationships, labelled AD, TT and NR. In Figure 1, these are drawn in the space "consumption" vs. "labour", C vs. ℓ. The horizontal AD locus shows the Home aggregate demand in real terms, as the ratio of the monetary stance to the price level: $C=\mu/P$. The upward sloping TT locus shows the level of consumption that Home agents obtain (at market prices) in exchange for ℓ units of labour. The slope of the TT locus depends on the (exogenous) productivity level Z, and the (endogenous) price of domestic GDP (Y=Zℓ), in terms of domestic consumption τ, i.e. $C = \tau Z \ell$. Since agents consume both local goods and imports, τ rises with an improvement in the terms of trade of the Home country, conventionally defined as the price of imports in terms of exports. The vertical NR locus marks the equilibrium employment in the flexible prices (or natural rate) allocation, ℓ^{flex}. Because of fims' monopoly power, ℓ^{flex} is inefficiently low. To stress this point, Figure 1 includes the indifference curve passing through the equilibrium point E, where it crosses the TT locus from above: with monopolistic distortions, the marginal rate of substitution between labour and consumption differs from the marginal rate of transformation.

With flexible prices, the macroeconomic equilibrium is determined by the NR locus and the TT locus. For a given μ, nominal prices adjustment ensures that demand is in equilibrium. With nominal rigidities, instead, the equilibrium is determined by the AD locus and the TT locus. Depending on the level of demand, employment may fall short, or exceed, the natural rate, opening employment and output gaps proportional to (ℓ^{flex} -ℓ).

Goods are supplied by a continuum of firms, each being the only producer of a differentiated variety of the national good. With nominal rigidities, manager optimal set prices as to maximize the market value of the firm.[2] In the CP-OR model, where prices are preset for one period and marginal costs coincide with unit labour costs $W/Z=\mu/Z$, optimal pricing takes the form:

$$p_H = markup \cdot E \left(\overbrace{\frac{\mu}{Z}}^{\text{marginal cost}} \right)$$

(E denotes conditional expectations). Home Firms selling in the domestic market charge the optimal markup over *expected* marginal costs. Observe that, if prices were flexible, the above expression would include current instead of expected costs.

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[2] Since households are assumed to own firms, the discount factor used in calculating the present value is the growth in the marginal utility of consumption

Modelling nominal rigidities in the exports market, however, raises the following issue: are export prices sticky in the currency of the producers, or in the currency of the destination market? In the NOEM literature, this issue has fed a extensive debate on the international transmission mechanism and the design of optimal stabilization policies, discussed below.

2. The international transmission mechanism and the allocative properties of the exchange rate

According to the received wisdom in traditional open macro theory, exchange rate movements play the stabilizing role of adjusting international relative prices in response to shocks, when frictions prevent or slow down price adjustment in local currency. At the heart of this view is the idea that nominal depreciation transpires into real depreciation, making domestic goods cheaper in the world markets, hence re-directing world demand towards them: hence exchange rate movements have 'expenditure switching effects'.

Consistent with this view, NOEM contributions after Obstfeld and Rogoff (1995) draws on the Mundell-Fleming and Keynesian tradition, and posits that export prices are sticky in the currency of the producers. Thus the nominal import prices in local currency move one-to-one with the exchange rate. This hypothesis is commonly dubbed 'producer currency pricing,' henceforth PCP.

Under PCP firms preset P_H and P_F^*, thus the Home country's terms of trade $\varepsilon P_F^* / P_H$ deteriorate with unexpected depreciation. Moreover, as long as demand elasticities are identical in all markets, firms have no incentive to price-discriminate: the price of exports obeys the law of one price, i.e. $P_H^* = P_H/\varepsilon$ and $P_F = \varepsilon P_F^*$.

Monetary shocks have two distinct effects on the Home allocation and welfare. Expansions raise demand and output: because of monopolistic distortions in production, positive nominal shocks benefit domestic consumers by raising output towards its efficient (competitive) level. However, currency depreciation also raises the relative price of Foreign goods, reducing the real income of domestic consumers. In terms of Figure 1, monetary expansions depreciating the currency shift the AD locus upward, and cause the TT locus to rotate clockwise. The new equilibrium may lie either above or below the indifference curve passing through the initial equilibrium. In other words, Home welfare may rise or fall, depending on the relative magnitude of monopoly power in production, vis-à-vis the terms of trade externality, related to a country openness and degree of substitutability of Home and Foreign tradables.[3]

A noteworthy implication for policy analysis is that, in relatively open economies where terms of trade distortions are strong, benevolent policymakers may derive short-run benefits by implementing surprise monetary contractions, which appreciate the Home

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[3] The size of the monetary shock also matters: by the same argument by the theory of optimal tariffs, a country never gains from monetary shocks which are large enough to raise output up to its competitive (Pareto-efficient) level.

currency, and boost the purchasing power of Home consumers. In these economies, monetary policy can have a deflationary bias.

In the Foreign country, the welfare spillovers of a Home monetary expansion are unambiguously positive. Foreign consumers benefit from the terms-of-trade movement, which raise their income in real terms: the Foreign TT rotates counterclockwise. Cheaper imports reduce inflation, raising aggregate demand for a given monetary stance μ^*: the Foreign AD shifts upward.

The high elasticity of import prices to the exchange rate underlying the above analysis is however at odds with a large body of empirical studies, documenting that the exchange rate pass-through on import prices is far from complete in the short run, and deviations from the law of one price are large and persistent (see e.g. Engel and Rogers 1996, Goldberg and Knetter 1997, Campa and Goldberg 2005). This evidence has motivated a thorough critique of the received wisdom on the expenditure switching effects of the exchange rate. Specifically, Betts and Devereux (2000) and Devereux and Engel (2003) among others posit that firms preset prices in the currency of the markets where they sell their goods. This assumption, commonly dubbed 'local currency pricing' or LCP, attributes local currency price stability of imports mainly to nominal frictions, with far-reaching implications for the role of the exchange rate in the international transmission mechanism (see Engel 2003).

To the extent that import prices are sticky in local currency, a Home depreciation does not affect the price of final goods, hence it has no expenditure switching effects. Instead, it raises ex-post markups on Home exports: at given marginal costs, revenues in domestic currency from selling goods abroad rise. In contrast with the received wisdom, nominal depreciation strengthens a country's terms of trade: if P_F and P_H^* are preset during the period, the Home terms of trade $P_F/\varepsilon P_H^*$ improves when the Home currency weakens. In Figure 1, with LCP, a Home monetary expansion shifts aggregate demand AD upward, and rotates the TT counter-clockwise.

It follows that monetary authorities cannot derive short-run welfare benefits from surprise contraction. As currency depreciation improves the terms of trade, the inflationary bias in policy making is even stronger than in a closed economy.

International spillovers from Home monetary expansions are detrimental to Foreign welfare. If prices in local currency remain constant, a Home expansion does not affect at all the aggregate demand in the Foreign country. Yet, the adverse terms of trade movement forces foreign agents to work more, to sustain an unchanged level of consumption: for a given AD, the TT locus rotates clockwise. An interesting case with asymmetric transmission, is one in which the prices of exports are all preset in one currency, so that Home firms adopt PCP, while Foreign firms adopt LCP (see e.g. Devereux et. al 2003).

While the NOEM literature has encompassed additional real and financial aspects in the analysis of the transmission mechanism, the debate PCP versus LCP identifies essential building blocks of optimal stabilization policy.

3. International dimensions of optimal monetary policies

A defining question of open-economy macro is whether monetary and fiscal policy should react to international variables such as the exchange rate or the terms of trade, beyond the influence that these variables have on the domestic output gap (e.g. via external demand) and domestic inflation (e.g. via import prices). This is a research area where choice-theoretic NOEM models have comparative advantages relative to the traditional literature: indeed early NOEM contributions have established a set of original and provocative results, setting benchmarks for further analytical and quantitative studies.

To account for these results, consider the stabilization problem in a CP-OR economy with country-specific productivity uncertainty. In a flexible price environment (corresponding to the long run of the CP-OR model), a positive productivity shock in the Home country causes the world price of Home goods to fall. This raises both domestic and foreign demand for Home output, and worsens the Home terms of trade. On the contrary, with sticky prices, unexpected gains in productivity simply translate into lower employment: given μ and μ^* (hence given the exchange rate), current demand is satisfied with a lower labour input.[4]

However, under the hypothesis of PCP, it is easy to see that monetary policy in a sticky-price environment can support the flexible price allocation. Posit that monetary rules satisfy $\mu = \Gamma Z$, where Γ denotes a (possibly time-varying) variable indexing the level of nominal variables in the Home country. When such rules are implemented, any gain in productivity is matched by a proportional expansion of the monetary stance, which raises Home demand and depreciates the Home currency. Marginal costs remain constant in nominal terms (since $\mu/Z=\Gamma$): hence product prices in domestic currency would remain fixed even if there were no nominal rigidities. At the same time, however, exchange rate movements adjust international relative prices, as monetary policy moves ε in proportion to productivity changes.

A first benchmark result is that, in economies with the CP-OR features, monetary policy rules supporting the flexible price allocation are also optimal: no rule welfare-dominates complete marginal cost and output gap stabilization. This is true under different assumptions regarding nominal rigidities, including staggered prices setting and partial adjustment (see e.g. Clarida, Gertler and Galí 2002). Optimal monetary rules are completely 'inward-looking': welfare-maximizing central banks stabilize the GDP deflator, while letting the CPI fluctuate with movements in the relative price of imports. There is no need for monetary policies to react to international variables.

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[4] In Figure 1, a higher Z rotates the TT locus counter-clockwise. Holding the AD and the TT loci fixed, the equilibrium employment is below the natural rate. A fall in domestic prices would shift the AD locus up, while offsetting part of the rotation of the TT locus. The flexible price equilibrium always lie on the NR locus.

The optimality of rules supporting a flexible price allocation is not a general result. In the presence of multiple distortions monetary authorities are generally able to exploit nominal rigidities, and improve welfare relative to such allocation (Benigno and Benigno 2003 or Corsetti and Dedola 2005). Yet, holding PCP, it is unclear under which conditions deviating from full domestic stabilization could yield significant welfare gains.

A second result concerns the costs of inefficient stabilization. New-Keynesian theory has emphasized welfare costs from relative price dispersion when private pricing decisions are not synchronized (see e.g. Galí and Monacelli 2003). Early NOEM contributions have instead pioneered the analysis of the effect of uncertainty on the level of prices and economic activity. A simple example illustrates this point. Suppose that monetary policy responds to productivity shocks according to rule: $\mu = \Gamma Z^\gamma$. When $\gamma < 1$, marginal cost uncertainty due to insufficient stabilization implies $E(\mu/Z) = \Gamma E(1/Z^{1-\gamma}) > \Gamma$: by a straightforward applications of Jensen's inequality, expected marginal costs are higher than under complete stabilization. Higher costs transpire into higher prices both in nominal terms and relative to wages, reducing the average supply of domestic goods, thus exacerbating monopolistic distortions in the economy (see e.g. Sutherland 2005 and Kollmann 2002 for a quantitative assessment).

Similar effects, with potentially stronger welfare implications, are caused by a noisy conduct of monetary policy and exchange rate variability (see Obstfeld and Rogoff 1998). On empirical grounds, evidence consistent with the (NOEM) prediction that incomplete stabilization *and* monetary/exchange rate noise transpires into higher price levels and real appreciation, is provided by Broda (2006).

A third result, derived assuming LCP, defines a clear-cut argument in favour of policies with an international dimension. To the extent that exporters' revenues and markups are exposed to exchange rate uncertainty, their optimal pricing strategies will internalize the monetary policy of the importing country. In the CP-OR model, for instance, the price of Home import on domestic monetary rules:

$$P_F = markup\square E\left(\varepsilon \frac{\mu^*}{Z^*} \right) = markup\square E\left(\frac{\mu}{Z^*} \right)$$

Suppose that Home monetary authorities ignored the influence of their decisions on the price of Home imports. For the reason discussed above, import prices will tend to be inefficiently high. On the other hand, if Home monetary authorities want to stabilize Foreign firms' marginal costs, they can only do so at the cost of raising costs and markup uncertainty for Home producers, resulting in higher Home good prices. It follows that, to maximize Home welfare, Home policymakers should optimally trade-off the stabilization of marginal costs of all producers (domestic and foreign) selling in the Home markets.

When foreign firms profits are exposed to exchange rate uncertainty, optimal monetary rules are no longer inward-looking. The importance of Foreign shocks in the conduct of

monetary policy depends on the degree of openness of the economy, measured by the overall share of imports in the CPI (see Corsetti and Pesenti 2005a and Sutherland 2005, for a discussion of intermediate degrees of Pass-through, and Smets and Wouters 2002 and Monacelli 2005 for models with staggered price setting).

Notably, the case for an international dimension in monetary policy described above transpires into limited exchange rate variability. Since with LCP optimal monetary policies respond to both domestic and foreign shocks, national monetary stances tend to be more correlated relative to the case of inward-looking stabilization of output gaps. This implies lower exchange rate variability. In the baseline CP-OR model, the optimal policy rules actually prevent *any* short-run fluctuations of the exchange rate, a point stressed by Devereux and Engel (2003). But this exact result only holds when the weights of Home and Foreign goods in final expenditure are assumed to be identical across countries: Home and Foreign monetary authorities de facto stabilize the same weighted average of marginal costs. Non-traded goods or some Home bias in consumption would obviously imply asymmetries in the optimal monetary stances, which would be incompatible with a fixed exchange rate (Duarte and Obstfeld 2004, Corsetti 2006). Even if, with LCP, exchange rate variability does not perform any role in adjusting international prices, adopting a fixed rate regime would impose unwarranted constraints on the efficient conduct of monetary policy.

A fourth result concerns the desirability of international policy coordination. Leading NOEM contributions have fed considerable scepticism on this issue. At the core of this scepticism is the disappointing quantitative assessment of welfare gains from coordination. Using the CP-OR model, for instance, it is possible to build (PCP and LCP) economies where optimal monetary rules are identical whether national policymakers act independently, or cooperatively (maximizing an equally weighted sum of national welfare functions). When this exact result breaks down (depending on the elasticity of substitution between Home and Foreign tradables, and/or sector-specific shocks in the presence of nontradables), gains from coordination usually remain quite small (see e.g. Pappa 2004, Benigno and Benigno 2006).

The lesson from the NOEM literature stressed by Obstfeld and Rogoff (2002), is a new welfare-based argument against coordination: once policymakers independently pursue efficient stabilization policies in their own country (i.e. they 'keep their house in order'), the room for improving welfare through cooperation is quite limited (see Canzoneri et al. 2005 for a discussion).

The results reviewed above were first derived in highly stylized economies. A critical question directing current NOEM research is whether they would still hold in richer models with good quantitative performance.

4. Challenges to the NOEM literature

The debate on the role of exchange rate in the international transmission in the NOEM literature has generated empirical and theoretical work on market segmentation along

national borders, and its implications for international macroeconomic adjustment. As stressed by Obstfeld and Rogoff 2001, despite the ongoing process of real and financial globalization, frictions and imperfections appear to keep national economies 'insular'.

An important issue is the extent to which the evidence of local currency price stability of imports can be explained by nominal rigidities. It is well understood that the low elasticity of import prices with respect to the exchange rate is in large part due to the incidence of distribution (Burstein, Eichenbaum and Rebelo 2006). Several macro and micro contributions have emphasized the role of optimal destination-specific markup adjustment by monopolistic firms depending on market structure (Dornbusch 1997, Goldberg and Verboven 2001), or vertical interactions between producers and retailers (Corsetti and Dedola 2005).

The main point is that low pass-through is not necessarily incompatible with expenditure switching effects (see e.g. Obstfeld 2002). In this respect, Obstfeld and Rogoff 2000 emphasizes that, in the data, nominal depreciation does tend to be associated with deteriorating terms of trade, consistent with the received wisdom. This piece of evidence clearly sets an empirical hurdle for LCP models assuming a high degree of price stickiness in local currency (see Corsetti, Dedola and Leduc 2005 for a quantitative assessment). Interestingly, estimates of LCP models downplaying price discrimination, distribution and other real determinants of incomplete pass-through predict that the degree of price stickiness is implausibly higher for imports than for domestic goods, a result suggesting model mis-specification (see e.g. Lubik and Schorfeide 2006).

Moreover, the currency denomination of exports prices should be treated as an endogenous choice by profit maximizing firms (see e.g. Bacchetta and VanWincoop 2005 and Devereux et al. 2004). To appreciate the contribution by the NOEM literature on this issue, recall that, in the CP-OR models explained above, expansionary monetary shocks unrelated to productivity raise nominal wages and marginal costs, while depreciating the currency. For a firm located in a country with noisy monetary policy, pricing its exports in foreign currency (i.e. choosing LCP) is quite attractive, as it ensures that revenues from exports in domestic currency will tend to rise in parallel with nominal marginal costs, with stabilizing effects on the markup. This may help explaining why exporters from emerging markets with relatively unstable domestic monetary policies, prefer to price their exports to advanced countries in the importers' currency. The same argument, however, suggests that LCP is not necessarily optimal for exporters producing in countries where monetary policy systematically stabilizes marginal costs (see Goldberg and Tille 2005 for empirical evidence).

In conclusion, it is important to emphasize that the discussion above is far from exhausting the range of topics and issues analyzed by the NOEM literature, which has marked a radical change of paradigm in international macro. Based on modern analytical and quantitative tools, NOEM contributions have undertaken a systematic reconsideration of classical themes including overshooting (e.g. Hau 2000); current account, debt and exchange rate dynamics (e.g. Cavallo and Ghironi 2002; Ganelli 2005; Ghironi 2006), exchange rate uncertainty and trade (e.g. Bacchetta and Van Wincoop 2000); fiscal policy

(e.g. Adao et al. 2006). An important set of papers delve into empirical analysis of the model (e.g. Bergin 2003 and Lubik and Schorfeide 2006). New waves of studies are currently exploring endogenous tradability and market dynamics at business cycle frequencies, and building model integrating current account dynamics with international portfolio diversification.

Yet most NOEM contributions so far specify models predicting a counterfactually high degree of consumption risk sharing: even when financial markets are incomplete, intertemporal trade and terms of trade spillovers ensure that the consumption risk of productivity shocks is contained, and the market allocation is not too distant from the efficient one (see e.g. Chari et al. 2002). Not only this is inconsistent with a large body of evidence (see Backus and Smith 1993). Most crucially, it may limit the ability of NOEM model to comprehend significant cross-border spillovers and policy trade-offs. Similarly, in most models the exchange rate is tightly related to fundamentals, at odds with the so-called disconnect puzzle. Further progress in these areas is crucial towards the fulfilment of the NOEM research agenda.

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