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Robustness of the Overshooting Phenomenon

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To overshoot or not: source of shocks matter

- Message of the Dornbusch overshooting: nominal exchange rates are more volatile than justified by the long-run economic fundamentals
- But: flex exchange rates do not always respond as strongly to fundamentals as in the original Dornbusch model; they may even respond with the wrong sign
- Also the respose may be severely delayed as in the model of Gourinchas and Tornell (2004, "Exchange Rate Dynamics and Distorted Beliefs", *Journal of International Economics 64, pp. 303 - 333)*
- So, if the overshooting phenomenon is not an absolute necessity, but only a possibility, this would certainly increase the model's potential to explain exchange rate movements, particularly in the post 1973-period (= floating)

Consequences of a supply shock

- As a starter, assume that there is a shock to aggregate supply ($\overline{y}$), eg. it increases unexpectedly and permanently
- The long-run solution to the exchange rate is, be it recalled

$$\overline{s} = \left(h^{-1} - k\right)\overline{y} + m + lr^{f}$$

which, by taking the partial derivative w.r.t. $\overline{y}$, implies

$$\frac{\partial \overline{s}}{\partial \overline{y}} = h^{-1} - k \gtreqless 0$$

Consequences of a supply shock

- Hence, a high income elasticity of money demand, k, or high elasticity of aggregate demand w.r.t. the real exchange rate, h, would make an appreciation more likely
- What about the short-run, or impact effect? In the short-run the exchange rate evolves as (from money demand)

$$\begin{aligned} m - p &= k\bar{y} - l(r^f + \Theta(\bar{s} - s)) \iff \\ s &= \bar{s} + \frac{m - p - k\bar{y} + lr^f}{l\Theta} \end{aligned}$$

so that

$$\frac{\partial s}{\partial \bar{y}} = \frac{\partial \bar{s}}{\partial \bar{y}} - \frac{k}{l\Theta} = h^{-1} - k\left(1 + \frac{1}{l\Theta}\right)$$

which increases the likelyhood of an appreciation somewhat, but the sign remain ambiguous

The Price Level

- Now, remember that the long-run price level is given by

$$\overline{p} = L = m - k\overline{y} + lr^f$$

so that the effect of the supply shock on the price level is negative

$$\frac{\partial \overline{p}}{\partial \overline{y}} = -k$$

- So, what's going on? First, note that the long-run real exchange rate is

$$\overline{q} = h^{-1}\overline{y}$$

The Long-Run Real Exchange Rate

- Hence

$$\frac{\partial \overline{q}}{\partial \overline{y}} = h^{-1}$$

so that

$$\frac{\partial \overline{s}}{\partial \overline{y}} = \frac{\partial \overline{q}}{\partial \overline{y}} + \frac{\partial \overline{p}}{\partial \overline{y}}$$

- Conclusion: which of the effects dominates in the long-run, real exchange rate or the domestic price level; an additional element for the short-run exchange rate effect comes from the long-run price level effect (which fall on a positive supply shock)
- So the long-run nominal exchange rate cannot strenghen (ie. fall) as much as the domestic price level, or even has to weaken (ie. rise) for the domestic currency to weaken in *real terms* (ie. $\overline{q}$ to rise) after a positive supply shock

Three Cases

- We can distinguish three cases:
  1. $h^{-1} - k < 0$; in this case both $\frac{\partial \bar{s}}{\partial \bar{y}} < 0$ and $\frac{\partial s}{\partial \bar{y}} < 0$; furthermore $\frac{\partial s}{\partial \bar{y}} < \frac{\partial \bar{s}}{\partial \bar{y}}$; although the domestic currency strenghens in the short- and long-run, the short-run effect is stronger $\Longrightarrow$ overshooting
  2. $h^{-1} - k > \frac{k}{l\Theta}$; in this case $\frac{\partial \bar{s}}{\partial \bar{y}} > 0$ and $\frac{\partial \bar{s}}{\partial \bar{y}} > \frac{\partial s}{\partial \bar{y}} > 0$; long- and short-run nominal depreciation; the short-run effect smaller $\Longrightarrow$ undershooting
  3. $0 < h^{-1} - k < \frac{k}{l\Theta}$; in this case $\frac{\partial \bar{s}}{\partial \bar{y}} > 0$ and $\frac{\partial s}{\partial \bar{y}} < 0$; long-run nominal depreciation and short-run appreciation
- Note further that given goods market equilibrium ($y^d = \bar{y}$), the domestic price level can be written as (from the aggr. demand eq.)

$$p = s + \frac{\bar{y}}{h}$$

An alternative Representation

- You can draw this equation as an upward sloping curve in the (s, p)-space, which, since it represents *goods market equilibria,* can be called the IS-curve
- Combining money market equilibrium $(m^d = m^s = m)$ with asset market equilibrium (UIP), we have

$$p = L - l\Theta\left(s - \overline{s}\right)$$

  which gives you the combination of the domestic price level and the (short-run) nominal exchange rate that sustains equilibrium in the monetary sector; note how asset markets are incorporated
- You can draw this equation as a downward sloping curve in the (s, p)-space

Case 1 graphically

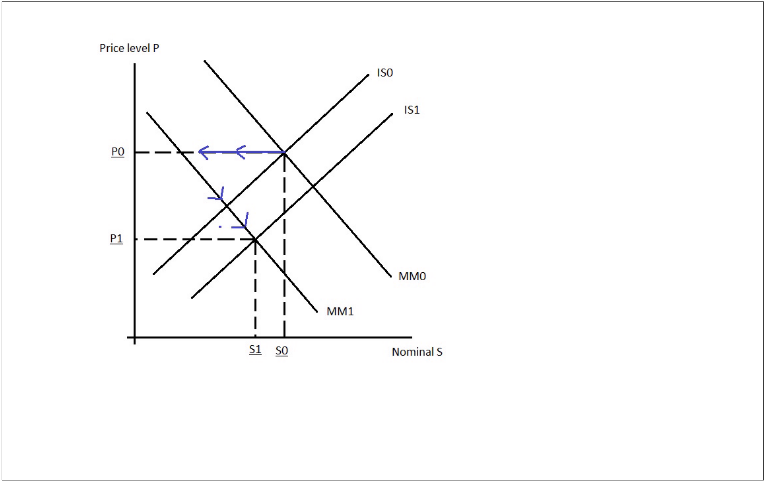

Figure: Case 1: Overshooting after a positive supply shock.

Demand Driven Output

- Next, keep the model the same except that the money demand depends on actual output or aggregate demand, denoted by y $(=y^d)$

$$m - p = ky - lr$$

- The long-run solution of the model is the same as before; the difference is with the short-run behaviour or the endogenous variables
- Imposing goods market equilibrium $y = \overline{y}$, we once again obtain

$$p = s + \frac{\overline{y}}{h} \qquad \text{(IS)}$$

while the money market equilibrium gives us

$$\begin{aligned} p &= m - kh(s-p) + l[r^f + \Theta(\overline{s} - s)] \iff \\ (1-kh)\,p &= -(kh + l\Theta)s + m + lr^f + l\Theta\overline{s} \end{aligned}$$

Demand Driven Output

- Since the long-run price level is

$$\bar{p} = m - k\bar{y} + lr^f$$

and the long-run nominal exchange rate is

$$\bar{s} = (h^{-1} - k)\bar{y} + m + lr^f$$

- Hence, the equation for the MM-curve can be written as

$$p = -\left[\frac{kh + l\Theta}{1 - kh}\right] s + \frac{(1 + l\Theta)(m + lr^f) + l\Theta(h^{-1} - k)\bar{y}}{1 - kh} \quad \text{(MM)}$$

Demand Driven Output

- As before with the supply shock, the macroeconomic adjustment under demand driven output can be characterized in the (p, s) -space using the IS and MM curves
- If $1 - kh \neq 0$, the solution to the (short-run) nominal exchange rate can be obtain by solving for the nominal exchange rate in the MM-equation (, since the price level is fixed in the short run!!)

$$\begin{aligned}
\left[\frac{kh + l\Theta}{1 - kh}\right] s &= -p + \frac{(1 + l\Theta)(m + lr^f) + l\Theta(h^{-1} - k)\overline{y}}{1 - kh} \\
s &= \left(\frac{1 + l\Theta}{kh + l\Theta}\right) m + \frac{(1 + l\Theta) lr^f + l\Theta(h^{-1} - k)\overline{y}}{kh + l\Theta} \\
&\quad - \left(\frac{1 - kh}{kh + l\Theta}\right) p
\end{aligned}$$

- So the short-run effect on the nominal exchange rate of a permanent increase in the money supply

$$\left.\frac{\partial s}{\partial m}\right|_{dp=0} = \left(\frac{1 + l\Theta}{kh + l\Theta}\right) \gtreqless 1$$

Demand Driven Output

- Overshooting will occur if $\left(\frac{1+l\Theta}{kh+l\Theta}\right) > 1$, that is if $1 + l\Theta > kh + l\Theta$, or $1 - kh > 0$
- This is equivalent to assuming or requiring the MM-curve has a negative slope - see the MM-equation above
- What's the intuition? First of a unit permanent increase in the money supply will weaken the domestic currency in the long run by the same amount, but by more in the short-run; hence $\bar{s} - s$ turns negative supporting an increase (via interest rates) in the money demand by $l\Theta\Delta\left(\bar{s} - s\right)$; weaker domestic currency will lead to an increase in aggregate demand in the goods market by $h\Delta s$ (price level fixed!), which, in turn supports an increase in money demand by $kh\Delta s$; hence, kh has to be smaller than one in order for the increase in money to match the unit increase in the money supply demand

Demand Driven Output

- What about the special case of $1 - kh = 0$? This is the condition for a *vertical* MM-curve
- There is no overshooting in this case:
  - checking ~~hecking~~ from the MM-equation above reveals that the short-run nominal exchange rate weakens one-for-one with the increase in the money supply (coefficient $= 1$) in this case
  - as the long-run exchange rate also weakens one-for-one with the increase in the money supply, $\Delta\left(\bar{s} - s\right) = 0$ and domestic interest rate does not change to support an increase in the money demand
  - weaker currency increases aggregate output by h ($\Delta s = 1$), which, in turn, increases money demand by kh, thus supporting the required unit increase in money demand