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Sticky import prices and J-curves

Philippe Bacchetta*[†]

Studienzentrum Gerzensee, 3115 Gerzensee, Switzerland
Institut d'Anàlisi Econòmica, Campus Universitat Autnoma de Barcelona, 08193 Bellaterra, Barcelona, Spain

Stefan Gerlach

Bank for International Settlements, Basle, Switzerland

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Abstract

We show that devaluations lead to a J-curve when imported goods are durable and import prices adjust slowly to exchange rate changes. The J-curve effect is caused by intertemporal speculation as import prices are low relative to future prices immediately after a devaluation.

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1. Introduction

The traditional explanation of why J-curves arise is that while a depreciation of the domestic currency increases import prices quickly, import quantities adjust only gradually. A depreciation may therefore increase the value of imports in the short run, generating a J-curve.

However, the assumption of immediate 'passthrough' of exchange rate changes to prices is unsatisfactory on two grounds. First, there is ample empirical evidence that import prices adjust slowly to exchange rate changes.[1] Second, Dohner (1984), Gottfries (1986), and Froot and Klemperer (1989) show that gradual passthrough of exchange rate changes to prices is optimal for firms if demand adjusts *slowly* to price changes.

This paper shows that J-curves can also arise if import prices adjust slowly to exchange rate changes and quantities are adjusting freely. Thus, a rapid passthrough is not necessary for J-curves to arise. The intuition is simple. If import prices are sticky, consumers anticipate future import prices to rise after a devaluation and therefore reallocate their purchases over time. This intertemporal reallocation of purchases leads to the J-curve.

The paper is organized as follows. Section 2 discusses a model with sticky import prices. The specific form of price stickiness is described in Section 3. Section 4 shows that a devaluation produces a J-curve.

* Corresponding author.
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[1] Mann (1986) discusses the passthrough in the United States during the 1980s and contains references to the earlier literature.

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2. The model

We consider a small open economy, which takes world prices and the world interest rate as given, with infinitely-lived consumers. The exchange rate, s, is fixed. Domestic residents hold a quantity, b, of foreign assets (denominated in foreign currency) yielding a real return, r. There are non-tradable, non-durable, and tradable durable goods in the economy. Real consumption of non-tradables is denoted c_N. Consumers hold a real stock of durables, d, that depreciates at the rate δ and can be increased by new purchases of tradables, c_T, so that

$$\dot{d} = c_T - \delta \cdot d . \tag{1}$$

The production of both goods is fixed and is equal to y_N for non-tradables and to y_T for tradables, with domestic prices p_N and p_T. The foreign price of tradables is normalized to unity. In the long run, the law of one price holds, so that $p_T = s$. In the short run, however, domestic prices adjust slowly to exchange rate changes and the law of one price is not satisfied: after a devaluation we have $p_T < s$. Section 3 describes the behavior of p_T more precisely.

The individual maximizes utility which depends on the consumption of non-tradables and the stock of tradables:

$$V = \int_0^\infty e^{-rt} U(c_N, d)\, dt . \tag{2}$$

Wealth in terms of foreign currency is

$$w = b + \frac{p_T}{s} \cdot d . \tag{3}$$

The evolution of w over time is

$$\dot{w} = r \cdot w + \frac{p_N}{s} \cdot (y_N - c_N) + \frac{p_T}{s} \cdot (y_T - \beta \cdot d) - \tau , \tag{4a}$$

where τ is a lump-sum tax described below. Moreover, $\beta = r + \delta - \dot{p}_T / p_T$ represents the opportunity cost of holding durables, which we assume is always positive. We impose a standard solvency condition:

$$\lim_{t \to \infty} w(t) \cdot e^{-rt} = 0 . \tag{4b}$$

Maximizing (2) subject to (4), we obtain

$$\frac{U_T}{U_N} = \beta \cdot \frac{p_T}{p_N} . \tag{5}$$

Thus, the marginal rate of substitution equals relative prices times the opportunity cost of durables. Since the stock of tradables can be adjusted discretely (d may jump), there may be both stock and flow adjustments in the trade balance. As the trade balance is plus or minus infinity whenever d jumps, we perform the analysis in terms of the stock of tradables.

We end this section by deriving an expression for the flow adjustment of the trade balance after a devaluation. Differentiating (5) yields

$$\dot{d} = \frac{U_N}{p_N \cdot U_{TT}} \cdot [(\delta + r)\dot{p}_T - \ddot{p}_T] . \tag{6}$$

Equation (6) shows that the rate of price change plays a central role in determining the stock of tradables. If the passthrough after a devaluation is immediate ($\dot{p}_T = \ddot{p}_T = 0$), we have $\dot{d} = 0$. However, if prices adjust slowly after a devaluation and the adjustment slows down over time ($\dot{p}_T > 0$ and $\ddot{p}_T < 0$), we have $\dot{d} < 0$ (as $U_{TT} < 0$), so that consumers' holdings of tradables are declining (the trade balance is improving). Note, however, that (6) describes the *flow* adjustment of the trade balance after the devaluation and shows that the trade balance is improving. Section 4 shows that the *stock* adjustment in d at the instant of the devaluation worsens the trade balance.

As (6) indicates, we need to specify next the behavior of $\dot{p}_T$ and $\ddot{p}_T$ after a devaluation.

3. Staggered prices

We model the passthrough of exchange rate changes to import prices following Calvo (1983a,b): firms in the traded goods sector set prices for finite intervals of time. For simplicity we assume that prices in the non-tradable sector are perfectly flexible.

The tradable sector consists of a continuum of firms on the interval [0, 1]. Each firm produces a fixed amount y_T and imports m_T. Since the foreign price of tradables is normalized to unity, imported goods cost s to the firm. The selling price, p_{Ti}, is set by firm i for a fixed amount of time which is *iid* across firms. The probability that the length of the interval is h is given by

$$\theta \cdot e^{-\theta h} . \tag{7}$$

The expected length of the interval is thus $1/\theta$.

When the price fixing interval expires after a devaluation, the firm resets its price equal to the new steady-state price level $\bar{p}_T = s_1$, where s_1 is the new exchange rate. At any time t after a devaluation, there are two groups of firms: firms that have reset prices to s_1 and firms still selling at the old price s_0, where s_0 is the initial exchange rate. The price level, p_T, is thus a weighted average of the two exchange rate levels, where the weights are the proportions of 'new' and 'old' firms:

$$p_T(t) = s_1 \cdot \theta \cdot \int_0^t e^{-\theta z} \, dz + s_0 \cdot \theta \cdot \int_t^\infty e^{-\theta z} \, dz \tag{8}$$

$$= s_1 - (s_1 - s_0) \cdot e^{-\theta t} . \tag{9}$$

Differentiating (8) and using (9) yields

$$\dot{p}_T = \theta \cdot (s_1 - p_T) , \tag{10}$$

so that the price of tradables is increasing after a devaluation and reaches a steady state when $p_T = s_1$. As in Calvo (1983b), we assume that there exists a 'price regulation mechanism' (PRM), which ensures that the actual price of tradables paid by each consumer is the same and is equal to p_T, and rules out any profit or loss from importing goods. The first role implies that the PRM refunds $s_1 - p_T$ to consumers who bought from firms with the new price and taxes $p_T - s_0$ the other consumers. The second role means that firms with old prices are subsidized by $s_1 - p_T$ on their imports. Any surplus or deficit of the PRM is redistributed to consumers in a lump-sum manner. In equilibrium, the lump-sum tax from the PRM expressed in foreign currency is

$$\tau = (s_1 - p_T) \cdot (c_T - y_T)/s_1 . \tag{11}$$

This tax represents the subsidized exchange rate loss to 'old' firms.

4. The J-curve

This section shows that a devaluation leads to a J-curve if traded goods prices are sticky. Using (6) and (10), and linearizing around the new steady state after the devaluation, we obtain an expression for the path of d:

$$\dot{d} = \lambda \cdot \theta \cdot (s_1 - p_{\mathrm{T}}) , \tag{12}$$

where $\lambda \equiv (r + \delta + \theta) \cdot \bar{U}_{\mathrm{N}} / (\bar{p}_{\mathrm{N}} \cdot \bar{U}_{\mathrm{TT}}) < 0$. After a devaluation, $s_1 > p_{\mathrm{T}}$, which implies that the stock of tradables is declining. Integrating (12):

$$d(t) = d(0) + \lambda \cdot (s_1 - s_0) \cdot (1 - \mathrm{e}^{-\theta t}) , \tag{13a}$$

where $d(0)$ denotes the stock of durables immediately after the devaluation. Thus, the new steady-state level of tradables, $\bar{d}$, is

$$\bar{d} = d(0) + \lambda \cdot (s_1 - s_0) . \tag{13b}$$

To solve for $\bar{d}$, we need to know $d(0)$, which is found from the intertemporal budget constraint. The appendix shows that

$$d(0) = d_0 + \Delta , \tag{14}$$

where d_0 is the level of durables immediately before the devaluation and Δ depends on the parameters of the model. Since $\Delta > 0$, (14) implies that the stock of tradables jumps up after a devaluation [that is, $d(0) > d_0$]. The appendix also shows that $\bar{d} < d_0$, that is the new steady-state stock of tradables is lower than before the devaluation. Thus, a devaluation leads to a J-curve and is not neutral in the long run.

5. Conclusions

This paper shows that a devaluation leads to a J-curve when imported goods are durable if import prices adjust slowly to exchange rate changes. Thus, a rapid passthrough of exchange rate changes to import prices, as traditionally assumed, is not necessary for J-curves to arise.

Appendix

In this appendix we solve for $d(0)$ from the intertemporal budget constraint derived by integrating (4a), and using (4b) and (11):

$$\begin{aligned} &\delta \cdot \int_0^\infty d \cdot \mathrm{e}^{-rt} \cdot \mathrm{d}t + \frac{r}{s_1} \int_0^\infty p_{\mathrm{T}} \cdot d \cdot \mathrm{e}^{-rt} \cdot \mathrm{d}t + \int_0^\infty \left(1 - \frac{p_{\mathrm{T}}}{s_1}\right) \cdot \dot{d} \cdot \mathrm{e}^{-rt} \cdot \mathrm{d}t \\ &- \frac{1}{s_1} \cdot \int_0^\infty \dot{p}_{\mathrm{T}} \cdot d \cdot \mathrm{e}^{-rt} \cdot \mathrm{d}t = w(0) + \frac{y_{\mathrm{T}}}{r} . \end{aligned} \tag{A1}$$

Wealth after the devaluation is found from (3):

$$w(0) = w_0 + \left(\frac{s_0}{s_1} - 1\right) \cdot d_0 \,, \tag{A2}$$

where w_0 and d_0 are the initial levels of wealth and of tradables. w_0 is found from (4a) in the steady state. We substitute (A2), (13a), (12), and (9) into (A1), which yields

$$d(0) = d_0 + \Delta \,, \tag{A3}$$

where

$$\Delta = -\lambda \cdot (s_1 - s_0) \cdot \left[\frac{(\delta + r) \cdot s_1}{\delta \cdot s_1 + r \cdot s_0} \cdot \frac{\theta}{r + \theta}\right] > 0 \,.$$

Furthermore, $\bar{d} < d_0$ for small devaluations. Using (13b) and (A3) we have that $\bar{d} = d_0 + \Delta + \lambda \cdot (s_1 - s_0)$. Let $\nu = (s_1 - s_0)/s_0$ be the magnitude of the devaluation. We can then show that $\Delta < \lambda \cdot (s_1 - s_0)$ when $\nu < (r + \delta)/(\theta - \delta)$.

References

Calvo, G.A., 1983a, Staggered prices in a utility-maximizing framework, Journal of Monetary Economics 12, 383–398.

Calvo, G.A., 1983b, Staggered contracts and exchange rate policy, in: J.A. Frenkel, ed., Exchange rates and international macroeconomics (University of Chicago Press and National Bureau of Economic Research) 235–252.

Dohner, R., 1984, Export pricing, flexible exchange rates, and divergence in the prices of traded goods, Journal of International Economics 16, 79–101.

Froot, K. and P. Klemperer, 1989, Exchange rate pass-through when market share matters, American Economic Review 79, 637–654.

Gottfries, N., 1986, Price dynamics of exporting and import-competing firms, Scandinavian Journal of Economics 88, 417–422.

Mann, C., 1986, Prices, profit margins and exchange rates, Federal Reserve Bulletin 72, 366–379.