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The real income channel and contractionary devaluations in a heterogeneous agent model for Latin America

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Rationale

In Latin America, it is not unusual to see exchange rate depreciations in excess of 20% in a single year. Although depreciation tends to stimulate a country's net external demand, it does not always lead to increased output. It is worth understanding which channels may explain this outcome.

Takeaways

- In conventional macroeconomic theory, exchange rate depreciations have expansionary effects on economic activity. However, the empirical evidence shows that, in the case of emerging market economies, devaluing the exchange rate may cause output to contract.
- One channel that explains this evidence, known as the real income channel, operates through the erosion of purchasing power as a result of rising prices for imported goods, which can lead to a fall in the real consumption of households with limited access to financial markets.
- This article discusses a heterogeneous agent model calibrated for the main Latin American economies that allows the importance of this channel to be measured. The results show that this channel may have a sizable macroeconomic impact, particularly on economies more open to international trade.

Keywords

Depreciation, Latin America, real income.

JEL classification

F41, F31, E37.

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Introduction

While exchange rate depreciations generally stimulate a country's exports and reduce its imports, they do not always lead to increased output. Edwards (1986) was the first of many[1] to empirically show that a currency devaluation could (at least in the short term and in emerging market economies) cause output to shrink, rather than grow.[2] This is known as a contractionary depreciation or devaluation, and is caused by the existence of transmission channels that cut a country's domestic demand, sometimes by a larger amount than the growth in net external demand.

To better understand what may lie behind contractionary depreciation, it is useful to consider the main channels through which a fall in the exchange rate can affect economic activity. The first channel considered is the expenditure switching channel. Through this channel, a drop in the real exchange rate causes relative domestic and foreign prices to shift, leading to spending being diverted towards domestic goods, which become cheaper. This means that, all else being equal, exports rise and imports fall, resulting in higher aggregate demand. This channel is typically present in all the macroeconomic models of an open economy. A second channel, highlighted by more recent economic theory, is known as the real income channel. In this case, a depreciation of the exchange rate increases price levels because imports become more expensive in the local currency. This erodes household purchasing power and reduces aggregate demand insofar as consumption is sensitive to real income decline. As a result, the net effect of these two channels on aggregate demand may be positive or negative, depending on which one prevails. The change in the resulting aggregate demand will likewise lead to a rise or fall in the employment level, generating a multiplier effect on total output.[3]

The real income channel was identified by Díaz Alejandro (1963) as a theoretical channel that was potentially relevant to understanding why devaluations were often contractionary in Latin America. This channel tends to be absent in traditional representative agent macroeconomic models[4]

1 The studies by Campos (2022) and Vicondoa (2019) stand out among recent work offering evidence of contractionary devaluations in Latin America.

2 While there are also empirical studies that show that devaluations are expansionary, most of them, unfortunately, focus on measuring long-term effects and shed no light on events in the years immediately after the devaluation. A summary of the empirical literature on this issue can be found in Demir and Razmi (2022). One problem often encountered with this area of research is the neglect of methods to identify a causal relationship between movements in a country's exchange rate and its GDP. On this latter point, see, for example, the comments made by Woodford (2008) in his discussion of Rodrik's (2008) influential work.

3 The balance sheet channel is a third channel through which exchange rate fluctuations (especially sharp changes) affect output. This channel operates through the impact that movements in the exchange rate have on the local-currency value of foreign currency-denominated debt held by households and firms. Unexpected increases in the exchange rate worsen firms and households' financial position, which reduces consumption and aggregate investment and, consequently, aggregate demand, as with the real income channel. This third channel, however, is not analysed in this article.

4 Many of the quantitative models used by central banks and international organisations use the (representative agent) model in Galí and Monacelli (2005) as a starting point. Under this model, aggregate consumption does not significantly vary in response to temporary shifts in households' real income. There is also, therefore, no variation when an increase in the prices of imported goods temporarily depresses real wages.

(which are at the heart of the models used by central banks), but does appear in heterogeneous agent models. These latter models[5] combine idiosyncratic fluctuations in household income with constraints on borrowing. Thus, households vary in terms of their holdings of financial assets and their income, which means that their marginal propensity to consume also differs.[6] In this context, the response of aggregate consumption to changes in real income depends on the average marginal propensity to consume in the economy, which, in turn, depends on the income and wealth distribution.[7]

Quantifying the real income channel in Latin America

This article quantifies the size of the real income channel for Latin American countries using a dynamic heterogeneous agent model of an open economy. Specifically, a simplified version of the model recently developed by Auclert, Rognlie, Souchier and Straub (2021) is considered.[8] This model accounts for the real income and expenditure switching channels and the multiplier effect. In this model, a country's degree of trade openness influences the size of both the real income and expenditure switching channels. The more open a country, the higher the proportion of imported goods in the consumption basket and, therefore, the greater the erosion of households' purchasing power if the prices of these products rise following a depreciation of the exchange rate. However, countries with greater trade openness also benefit more from expenditure switching, since exports, which become cheaper internationally following a devaluation, are a greater share of output. The model is calibrated[9] such that in a steady state it replicates the average trade openness for each country between 2015 and 2019.

In order to quantify the magnitude of the real income channel, we consider simulation exercises based on an exogenous depreciation of the real exchange rate, and calculate the deviations from the model's steady state after two years. In line with Auclert, Rognlie, Souchier and Straub (2021),

5 Some recent examples of these models can be found in Kaplan, Moll and Violante (2018) and Auclert (2019).

6 The marginal propensity to consume measures the response of consumption to changes in income.

7 Households that have more financial assets behave very similarly to a household in a representative agent model; they are able to smooth temporary income changes without varying their consumption. Their marginal propensity to consume is low. In contrast, less wealthy households face borrowing constraints, which means that their consumption reacts more to drops in their current income. Such households have a high marginal propensity to consume. The aggregate response depends on the average marginal propensity to consume across all households.

8 Their model has one country – representing a Latin American economy – that is modelled as a small open economy. This country trades with the rest of the world and freely allows capital inflows and outflows. Its nominal exchange rate is flexible and the real exchange rate satisfies an uncovered interest parity condition. An exogenous increase in the international real interest rate that is not met by an equivalent increase in the local interest rate leads to a drop in the real exchange rate. Households in this economy consume both domestic and imported goods. The weight of imported goods in the utility function determines the country's degree of openness. Households receive income from their work and from the dividends paid out by goods producers. Similarly, households face idiosyncratic risks to their wages and their consumption decisions are constrained by the existence of a borrowing limit. Firms produce varieties of the domestic good using labour as the sole input and sell these varieties on a market characterised by monopolistic competition. The real wage is determined in a competitive market.

9 The internally calibrated parameters are the consumer discount rate, the weight of imported goods in the utility function and the elasticity of substitution between varieties of the domestic good (or equivalently the mark-up of firms in equilibrium). As well as trade openness, the other two conditions that are used to calibrate these internal parameters are the goods market equilibrium and the marginal propensity to consume. The latter targets that of Peru, the only Latin American country for which there is an in-depth estimation (Hong, 2023). The parameters that are not calibrated internally are taken, when possible, from Auclert, Rognlie, Souchier and Straub (2021).

the exercise assumes that the gap between the real exchange rate and its steady state narrows by 15% every quarter after the initial devaluation. The results are normalised so as to reflect the impact of a cumulative deviation of 1% in the real exchange rate after two years.[10] Moreover, and again in line with Auclert, Rognlie, Souchier and Straub (2021), the domestic real interest rate is assumed to remain constant over the time horizon of the exercise.[11]

In an initial exercise, the devaluation's impact on GDP is simulated assuming that exports and imports do not respond in the short term to the change in relative prices, so as to exclude the impact of the expenditure switching channel and identify the effect of the real income channel. In this exercise (see Chart 1.a), contractionary depreciations occur in all the countries, and are larger in those that have greater trade openness. Moreover, the multiplier effect amplifies the recession caused by the real income channel.

The second exercise considers that both exports and imports respond to the depreciation in the short term,[12] allowing for a quantification of the effects of both channels at the same time. In particular, the findings obtained show that the expansionary effect from the expenditure switching channel partially counters the recessionary impact of the real income channel (see Chart 1.b). Indeed, although the depreciations are contractionary in all cases, the size of the recession no longer corresponds to the degree of trade openness, as the magnitude of the impact of the expenditure switching channel is larger for more open countries.

Table 1 shows the results of the second exercise in greater detail. Taking all the channels into account, the impact on GDP is very similar across the countries, standing between 0.16 percentage points (pp) and 0.17 pp. However, this homogeneity masks important differences. The decomposition of the effects on domestic demand and those on net external demand shows a greater negative impact on the two in more open economies. The last three columns of Table 1 show the quantitative relevance of the real income channel in GDP and its components.[13] The real income channel is responsible for over half of the impact on domestic demand in the more open economies. While less relevant as a determinant of the impact on net external demand, it still explains a third of its total change in some countries.

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10 The model is solved numerically using the methodology described in Auclert, Bardóczy, Rognlie and Straub (2021). Specifically, we use linear and non-linear methods to calculate the general equilibrium impulse response functions (IRFs) of the aggregate variables. We use linear approximation methods for the aggregate variables, but non-linear behaviour caused by the idiosyncratic shocks is maintained in all cases. Since the exchange rate shock considered is small, no numerical differences are observed between the results obtained using linear methods and non-linear methods.

11 This assumption implies a Taylor rule coefficient to expected inflation of one, and allows the monetary policy to maintain constant real interest rates.

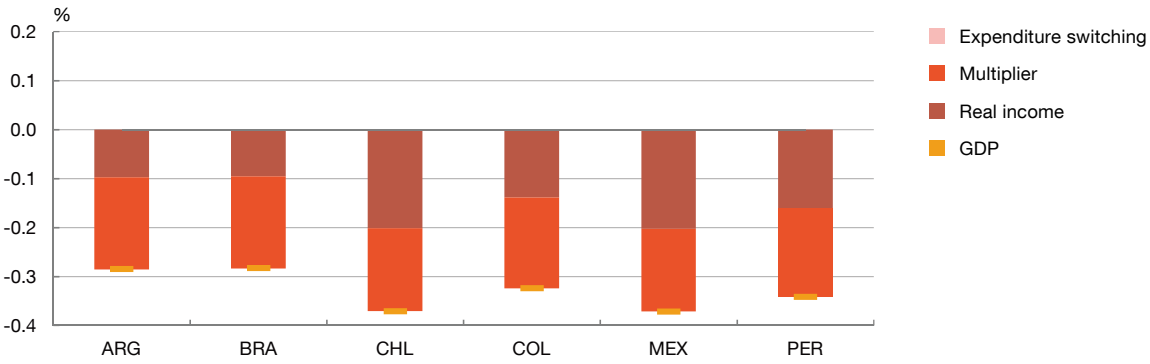
12 This exercise is based on a parametrisation of the quantitative model devised by Auclert, Rognlie, Souchier and Straub (2021), who use an international trade elasticity that is small in the short run. These small short-run elasticities are in line with the recent empirical studies on the matter (International Monetary Fund, 2019).

13 The channels are decomposed using general equilibrium IRFs obtained by drawing on linear methods and the share of consumption in GDP. The real income channel is obtained from the IRF of household consumption to changes in real wages and the evolution of the real wage in the equilibrium, keeping the level of employment constant. The multiplier effect is obtained from the IRF of household consumption to the level of employment, with real wages remaining constant. The expenditure switching channel is obtained from the IRF of exports and imports to the change in relative prices of exports and imports, keeping real wages and the employment level constant. The sum of these three channels coincides with the general equilibrium GDP impact, and they thus reflect an exhaustive decomposition of GDP.

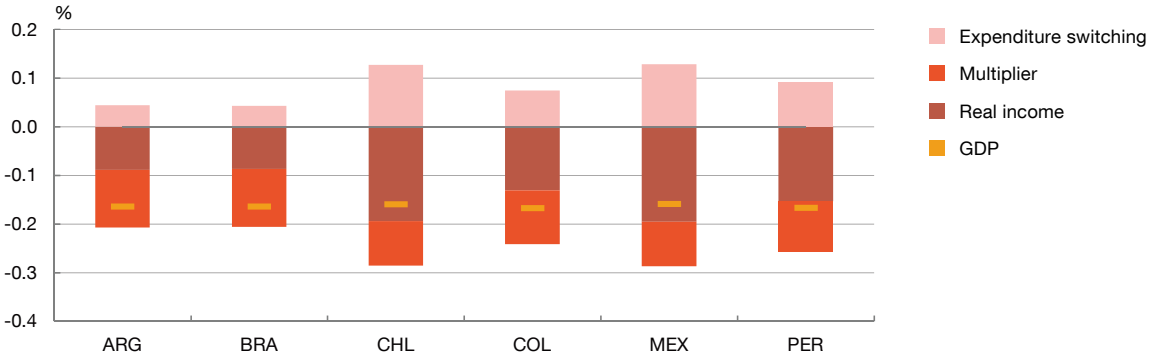
Chart 1

The real income channel is larger in countries that have greater trade openness

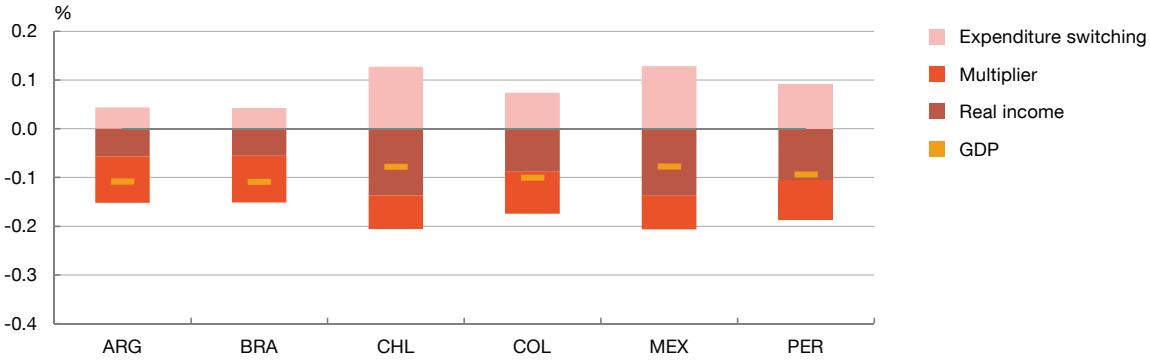
1.a Decomposition of the deviation in GDP following a real depreciation in the different channels (a)



1.b Decomposition of the deviation in GDP following a real depreciation in the different channels with positive trade elasticities (b)



1.c Decomposition of the deviation in GDP following a real depreciation in the different channels with a lower marginal propensity to consume (c)



SOURCE: Banco de España.

a The effects of a devaluation in the real exchange rate are simulated using the heterogeneous agent, open economy model of Auclert, Rognlie, Souchier and Straub (2021), calibrated according to each country's degree of openness. The exercise considers a persistent real depreciation, leading to a deviation in the real exchange rate over eight quarters. The cumulative sum of the deviations in the real exchange rate is 1% after eight quarters. In this exercise the real interest rate remains constant. All the magnitudes represented refer to cumulative deviations from the steady-state values after eight quarters. In this exercise the international trade elasticities are assumed to be zero.

b The original simulation (1.a) is repeated for the same parameter values, but raising the international trade elasticities of imports and exports in the short run to 0.2 and 0.1, respectively.

c The simulation (1.b) is repeated with positive elasticities, following a recalibration of the model, to generate an average steady-state marginal propensity to consume of 30% for all the countries.

Table 1
Effects of a depreciation in the real exchange rate

	Trade openness (%) (a)	Total result (b)				Real income channel only (b)		
		Domestic demand	Net external demand	GDP	Terms of trade (c)	Domestic demand	Net external demand	GDP
Argentina	27.6	-0.24	0.08	-0.16	-0.16	-0.08	0.01	-0.07
Brazil	26.8	-0.24	0.07	-0.16	-0.16	-0.07	0.01	-0.06
Chile	71.4	-0.45	0.29	-0.16	-0.56	-0.26	0.09	-0.17
Colombia	45.0	-0.31	0.14	-0.17	-0.29	-0.14	0.03	-0.11
Mexico	72.0	-0.45	0.29	-0.16	-0.56	-0.27	0.10	-0.17
Peru	54.2	-0.35	0.19	-0.17	-0.37	-0.18	0.05	-0.13

SOURCE: Banco de España.

a Trade openness (exports plus imports as a percentage of GDP) is calculated for the 2015-2019 average.
b Cumulative deviations after eight quarters from the steady-state values of the variables. The effects of a devaluation in the real exchange rate are simulated using the heterogeneous agent, open economy model of Auclert, Rognlie, Souchier and Straub (2021), calibrated according to each country's degree of openness. The exercise considers a persistent real depreciation, leading to a deviation in the real exchange rate. The cumulative sum of the deviations in the real exchange rate is 1% after eight quarters. The real interest rate is assumed to remain constant over the entire time horizon of the exercise. The columns grouped under "Total result" comprise the sum of the expenditure switching channel, the real income channel and the multiplier effect. The columns grouped under "Real income channel only" isolate the specific impact of that channel on the variables.
c The terms of trade are defined in this case as the ratio of production prices (which in this model coincide with export prices) to the consumption-basket prices, which also include imported products.

In any event, the size of the real income channel calculated for the Latin American countries is sensitive not only to the degree of trade openness, but also to changes in the model's other parameters, specifically the borrowing constraint households face. As mentioned above, the real income channel is attributable to the erosion of real income. However, the pass-through of the decline in real incomes to consumption and GDP depends on the borrowing constraint, which determines the average marginal propensity to consume in an economy. For this reason, we consider a third exercise in which, compared with the original calibration, the borrowing constraint is eased such that the equilibrium average marginal propensity to consume declines by half. Under this alternative calibration, in which households have a greater capacity to smooth their consumption in response to transitory shocks, the contractionary impact of the real income channel is smaller than in the original exercise (see Chart 1.c). This suggests that better access to the financial system can reduce the marginal propensity to consume as well as mitigate the contractionary effects of the real income channel of exchange rate depreciations.

Conclusions

Heterogeneous agent models can be used to quantify the size of the real income channel of exchange rate depreciations. Specifically, in these models, households vary in terms of their financial asset holdings and income and, as a result, in their marginal propensity to consume, which determines how an exchange rate devaluation will affect aggregate consumption. Thus, when the marginal propensity to consume in the overall economy is high (for instance, when many households have a limited capacity to smooth their consumption), the real income channel

predominates over the expenditure switching channel, potentially triggering a contractionary depreciation, a relatively common outcome in Latin American countries.

In the future, central banks using models of this kind will be able to take into account the real income channel when studying the transmission of depreciations to the rest of the economy in emerging market economies. The quantitative relevance of this channel also shows the potential importance of economic policies that can help mitigate the adverse effects of an exchange rate depreciation. For example, a policy that lowers barriers to financial inclusion would reduce the magnitude of the real income channel, at least to the extent that it increases households' capacity to ease the impact of changes in income on their consumption, making the depreciations more expansionary (or less contractionary) and, above all, less costly in terms of welfare.

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