

Trade Adjustment and Productivity in Large Crises*

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Abstract

1 Introduction

Episodes of large crises such as the Mexican crisis in 1994-1995, the East Asian crisis in 1997-1998, and the Argentine crisis in 2001-2002 are associated with large reversals in the trade balance. The dollar value of imports in Argentina, for instance, dropped by 80 percent and the trade balance climbed from -1 to 18 percent of GDP between 2000 and 2002. A second feature of these episodes is the large decline in real GDP and total factor productivity (TFP). Sandleris and Wright (2010) document a 12 percent decline in manufacturing productivity in Argentina between 2000 and 2002.¹

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¹For other crisis episodes, Meza and Quintin (2006) document that productivity declined by 8.6 percent in Mexico in 1994, by 15.1 percent in Thailand, and by 7.1 percent in South Korea during the East Asian crisis.

In this paper we do two things. First, we empirically characterize the mechanics of trade adjustment at the firm and product level during the Argentine crisis. Our analysis makes use of detailed firm-level customs data covering the universe of import and export transactions for Argentina during 1996-2008, a period that includes a dramatic nominal exchange rate depreciation and trade balance reversal. Second, we use a model of trade in intermediate inputs with heterogeneous firms, fixed import costs, and round about production to evaluate the channels through which the collapse in imports effects value added and TFP in manufacturing.

In the trade literature there is extensive analysis, both theoretical and empirical, of the impact of permanent shocks such as trade liberalizations on the extensive margins of adjustment, either via changing allocation of resources across firms (Melitz 2003) or changing product varieties (Krugman 1979). Here we ask, how empirically important are these various forms of extensive margin adjustment at business cycle frequencies, especially in a large crisis?²

We find the following facts for the Argentine crisis. First, the number of firms that exit the import market is large, but they explain a negligible share of the decline in imports. This is also the case for the number of imported product varieties. To elaborate, the number of importing firms dropped from over 15,000 to less than 7,000 over the first four quarters of the crisis and does not reach its previous levels for about 5 years. The number of distinct 10-digit Harmonized Tariff Schedule (HTS) product codes imported drops from about 13,000 to 10,000 over the same period and also takes about 5 years to recover. However, the net contribution of firm entry and exit explains about 7 percent of the 61 percent decline in imports during the crisis. Product entry and exit explains less than 13 percent of the decline. This finding holds when looking at the quarterly or annual frequency, when looking at normal times as well as during the crisis and recovery, and when separately considering each end-use category.

To our knowledge, these results are the first to demonstrate the tiny scale of extensive margin adjustment, defined as firms stopping all their import activity or a country stopping all imports of certain products, in the face of a such a massive shock. The lack of importance of this extensive margin follows from the high degree of concentration in international trade among a few key firms and sectors. The largest 5 percent of importing firms contributes

²Ghironi and Melitz (2005) build a model to highlight the impact of firm entry and exit decisions on business cycle moments.

approximately 85 percent of Argentina’s imports and does not change import status.³ Similarly, the largest 5 percent of imported 6-digit HTS categories together account for about 60 percent of imports. The high concentration in firm and product shares relates to the findings in Bernard, Jensen, and Schott (2009) and the small extensive margin is consistent with the findings in Bernard, Jensen, Redding, and Schott (2009) for U.S. data. Our finding extends their result to a dramatically larger trade adjustment episode in the Argentine experience.⁴

However, given that trade in most countries, including Argentina, is primarily in intermediate inputs, it is important to examine what happens to the bundle of imports at the firm level, as opposed to the country level. Even if a particular input variety continues to be imported at the country level, it may still be the case that several firms stop importing it and as such, experience changes in their own (and therefore aggregate) productivity. As an illustration, Figure 1 shows sample import activity of three large Argentine industrial manufacturing companies, all in the top 50 importers in Argentina: BGH S.A., Siderca S.A.I.C., and Siderar S.A.I.C. All three companies imported heavily in key intermediate input categories before the crisis, but stopped importing these inputs during the crisis.⁵ These products disappeared from the import bundle of these three companies, but this would not be observable in aggregate product data because other Argentine firms continued to make purchases in all of these categories during the same period. Further, while these three companies stopped importing these particular inputs, they would not appear in aggregate firm extensive margin calculations because they continued importing at least some other product throughout the crisis.

This leads us to our second empirical finding: When we define the extensive margin to include within-firm changes in the mix of imported categories and exporting countries, it be-

³As discussed below, we can rule out the possibility that the largest importers are simply huge distributors or import/export brokers.

⁴Also see di Giovanni and Levchenko (2009) who argue that this can imply the welfare impact of high entry costs into production is small.

⁵BGH imported industrial cooling fans and anti-vibration materials, largely from Motorola, during most quarters in 2000 and 2001. With the onset of the crisis and after the exchange rate shock, however, imports of those goods dropped to zero for 6 quarters, only to return in late 2003. Siderca, after importing more than \$2 million of tools for steel-cutting lathes in 2001 and spending more than \$200,000 on imported tools for aluminum smelting and mixing, exited those import markets completely in 2002 and early 2003. By late 2003, they returned to importing in those sectors and by 2004 spent almost \$9 million on those imported goods. Finally, Siderar’s imports included large volumes of bricks and combustibles, laminated steel sheets, and lifting equipment before the crisis. These branded products were largely from foreign design and manufacturing companies such as the Rima Group, Techint Italimpianti, and Vai Cosim. All three categories of imports showed zero volume starting with the onset of the crisis and devaluation, though several returned as large import categories after the crisis abated.

gins to play a significant role. This “within-firm” extensive margin, or sub-extensive margin, explains about half of the 61 percent decline in imports in the crisis year of 2002. As shown in Feenstra (1994), price indices must be adjusted to explicitly account for such changes in varieties. For example, a standard price index that ignores the decline in varieties in Argentina would underestimate the increase in input prices, thereby increasing the imputation of real intermediate input use and decreasing measured TFP. Calculations from the loss of varieties at the firm-level in our data imply that the true imported input price index is about 5 percent higher than the uncorrected price index. These corrections are much larger than what is implied by comparable calculations from aggregate data.

Third, we find that smaller importers experienced a greater percentage decline in imports than larger importers. Moreover, the extensive margin (firms exiting trade) or sub-extensive margin (firms dropping particular imported inputs) were more important sources of adjustment for small importers than for large ones. We demonstrate that these patterns are not explained by the importers’ primary sector fixed effect nor by the multinational status of the firm. Lastly, on the export side, the number of exported varieties for the country as a whole, as well as per firm, did not decline during the crisis.

It is well understood that changes in import costs can impact firm productivity through altering the number of varieties used when these inputs are imperfectly substitutable (Ethier 1982) or because of the difference in quality between domestic and foreign inputs (Grossman and Helpman 1991).⁶ We incorporate these channels in an environment with heterogeneous firms, monopolistic competition, round-about production and fixed costs of importing varieties. Each firm’s production function combines domestic and imported intermediate inputs that are imperfectly substitutable. We evaluate the implications for aggregate value added and productivity. We then numerically examine the response of trade, the various extensive and intensive margins of adjustment, and productivity to an increase in the relative price of imported inputs.

Aggregate productivity in this economy depends on both the exogenous technology of each firm (the ex ante source of heterogeneity) and the share of imported inputs in each firm’s input costs. In the presence of fixed costs, firms with better technology will import a larger number of foreign input varieties. This will give them a cost advantage over the smaller firms. In this environment, aggregate TFP is not a function simply of the average productivity

⁶This imperfect substitutability between domestic and imported intermediate inputs is also crucial to the amplification of financial shocks in Mendoza and Yue (2009).

level nor of the average share of imports in intermediate input spending. Rather, aggregate TFP is determined by the joint distribution of firm-level productivities and import shares. Consequently, aggregate TFP in two economies with the same underlying technology but differential access to import markets, because of, say, higher fixed costs, will have a different dispersion of firm level productivities, which we show implies different aggregate productivity levels. Or put differently, even taking as given the productivity distribution, two different shocks which produce the same aggregate import shares can have differing implications for aggregate TFP depending on the cross-firm joint distribution of technologies and firm-level import shares.

In our model, this distribution emerges endogenously because firms with different productivities will adjust with different combinations of the intensive, sub-extensive, and extensive margins. For example, the smallest importing firms adjust entirely via the extensive margin, reducing their import shares from positive levels to zero, while large firms adjust differently. Finally, due to round-about production, the effects of changes in import shares on value added and productivity are amplified by a factor equal to the inverse of one minus the share of intermediate inputs in production. As a simple illustration, we show in our simulation that this mechanism can easily deliver declines in manufacturing TFP on the order of 10 percent. (Future versions will more seriously aim at calibrating the model to Argentine data.)

This paper is related to many literatures. First, we contribute to the literature evaluating the importance of the different margins of adjustment to trade cost shocks at high and low frequencies. Previous papers typically consider trade liberalizations or secular trends, while we look specifically at trade adjustment in a large crisis. Our finding that the economy-wide product entry and exit margin plays a small role contrasts with the evidence in Goldberg, Khandelwal, Pavcnik, and Topalova (2009), which finds that following India's trade liberalization, 66 percent of the increase in imports can be explained by imports of new HTS 6 categories. Our findings are, however, in line with the results for the U.S. in Bernard, Jensen, Redding, and Schott (2009) as well as the calculations of Arkolakis, Demidova, Klenow, and Rodriguez-Clare (2008), who find that following a trade liberalization in Costa Rica the product extensive margin plays a small role. Even in a crisis as large as Argentina's, with an 80 percent drop in imports, the firm extensive and product extensive margin plays a small role.

Second, our paper is related to the literature that evaluates the impact of imported intermediate inputs on productivity. See, for instance, Amiti and Konings (2007) for the

impact of liberalization and increased trade in Indonesia, Goldberg, Khandelwal, Pavcnik, and Topalova (2009) in India, and Halpern, Koren, and Szeidl (2009) in Hungary. Halpern, Koren, and Szeidl (2009) structurally estimate and emphasize the sizeable productivity gains from access to imports when these imports are imperfectly substitutable for domestic inputs at the firm level. Our paper evaluates what this implies for aggregate productivity in an environment with round-about production and a large business-cycle frequency shock to the economy.

Finally, our paper relates to a third literature, exemplified by Hsieh and Klenow (2008) and Jones (2010), which examines the impact on aggregate TFP of exogenous distortions that result in resource misallocations across firms, including in environments with round-about production. We propose, empirically document, and endogenize in our model a specific type of channel that acts isomorphically to these distortions.

We focus on Argentina due to the availability of long-dated and detailed transaction-level data surrounding an acute sudden stop and exchange rate shock. Our analysis, however, has broader relevance and can help answer the question of how trade adjusts, and the impact of this adjustment on the macroeconomy, during business cycles and crisis episodes. For example, the global financial crisis of 2008-2009 was also associated with a sharp drop in world trade and near or complete current account reversals in several economies. Our model may also be informative about the recent experience in these countries.

We proceed as follows. Section 2 gives an overview of the Argentine Crisis of 2001-2002, Section 3 reviews our data, and Section 4 details the key empirical findings. Section 5 introduces our model and calibration, and Section 6 reviews the simulation results. We then conclude.

2 The Argentine Crisis: 2001-2002

Argentina, after eight years of growth averaging just under 6 percent per year, entered a recession in 1999, with GDP, consumption, and investment all declining in real terms. As shown in Figure 2(a), the recession worsened sharply in the fourth quarter of 2001, with real GDP ending the first quarter of 2002 more than 16 percent below its level a year earlier. This decline was coupled with a rapid and massive currency depreciation. Figure 2(b) shows the nearly 300 percent nominal depreciation of the Argentine peso relative to the dollar, and Figure 2(c) shows that the import price index, when denominated in U.S. dollars, barely