Appendix (for Online Publication) to

Sudden Stops, Productivity, and the Exchange Rate

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A Aggregate Data

A.1 Data Sources

Annual data on the current and capital accounts for all available countries comes from the IMF's International Financial Statistics Database (IFS) for the period 1990-2015 and complemented with data on GDP per capita growth from the World Bank's World Development Indicators Database.[1]

To characterize the macroeconomic dynamics during a sudden stop, I assemble data on output, final private consumption, employment, wages, total factor productivity (TFP), the current account deficit, and the real exchange rate. All series are drawn from the World Development Indicators, except for TFP—which is obtained from the Conference Board Total Economy Database—and the current account deficit, which comes from the World Economic Outlook Database.

Employment is measured in hours worked. Since consistent cross-country wage series are not available, I proxy wages using the labor compensation share of GDP, also from the Conference Board's Total Economy Database. An implied average wage is then constructed by multiplying this labor share by total GDP (from the World Development Indicators) and dividing by total employment (from the Conference Board).

A.2 Identifying Sudden Stops: Algorithm

The following algorithm combines elements of Calvo, Izquierdo and Mejía (2004) and Cavallo and Frankel (2008).

- Use IMF Balance of Payment annual data for all available countries in the period 1990-2015.
- Drop (i) small countries - in terms of population (below 1 million inhabitants) and in terms of wealth (below 1 billion USD); (ii) countries with incomplete time series.
- Compute year-to-year changes in the financial account.
- Compute rolling averages and standard deviations of the change in the financial account with a window length equal to ten years. Check that at least 60% of the observations in the window are available, otherwise set to missing.
- Identify reversal episodes as subsequent country-year observations that show reductions in the financial surplus half a standard deviation below the mean change as calculated in the previous step. Classify the first and last country-year observation as the start and end of each episode.

[1] I do not consider countries which are small, both in terms of population (below one million inhabitants) and in terms of GDP (below one billion USD). The final sample covers 119 countries.

- Filter to keep reversal episodes that contain at least one country-year observation with a reduction in the financial surplus one standard deviation above the mean change.
- Filter again to keep reversal episodes that are accompanied by a fall in GDP per capita during the same year or the year that follows immediately after. Surviving episodes are classified as sudden stops.

Note that one year episodes starting in 2009 are dropped from the final sample as they simply capture the global trade collapse that followed the burst of the 2008 financial crisis instead of a country-specific reversal of capital flows.

A.3 Robustness

This appendix presents robustness checks to the event study discussed in section 2. In the interest of space, only results for productivity are reported. Results for all other variables are available upon request.

Alternative Exchange Rate Classification The classification of episodes by exchange rate regime is essential to this exercise. I distinguish four regimes based on the degree of exchange rate flexibility (currency union, hard peg, soft peg and floating arrangement) building from an existing *de facto* coding system put together by Ilzetzki, Reinhart and Rogoff (2019). In the first column of Table A.2, I explore how robust results are to an alternative coding system. More specifically, I rely on Klein and Shambaugh (2008), which allow for regime changes at higher frequency. Although some episodes are now classified under a different exchange rate label, the same conclusions carry through.

A different robustness approach requires taking into account that the exchange rate regime might change during the sudden stop. In the main text, I classify episodes based on the exchange rate regime prevalent during the last year of the sudden stop. This is motivated by the fact that, historically, most countries abandoned pre-existing pegs as a response to a sudden stop, which through the lens of the model is equivalent to a nominal depreciation. However, there are also some cases in which failed currency pegs led to capital outflows, in the first place. The second column of Table A.2 classifies episodes based on the exchange rate regime prevalent at the start of the sudden stop. The response of productivity looks remarkable similar to the baseline under a floating arrangement and it is completely unchanged under a currency union.

Detrending Window Length The event-study analysis focuses on the cyclical component of macroeconomic variables, which requires removing medium-run trends prior to aggregation. In the baseline specification, I detrend each series using a linear trend estimated over the five-year pre–sudden-stop window. The choice of a five-year window reflects a trade-off between isolating medium-run trends and maximizing the number of sudden stop episodes for which sufficiently long pre-event data are available. To assess the sensitivity of the results to this choice, the third column of Table A.2 reports estimates obtained using a longer pre–sudden-stop window to fit the linear trend. While the magnitude of the estimated productivity response under floating exchange rate arrangements is somewhat attenuated, the qualitative pattern remains unchanged. In particular, productivity continues to decline significantly following sudden stops under floating regimes, while remaining broadly stable within currency unions. This confirms that the baseline findings are not driven by the specific choice of detrending window.

Controlling for Development Level One potential concern is that the exchange rate regime classification may be capturing other sources of heterogeneity across sudden stop episodes. A natural candidate is the level of economic development, as episodes occurring within a currency union are disproportionately concentrated among advanced economies. To address this issue, I re-estimate the event-study specification separately for advanced and emerging economies. Country classifications are taken from the IMF World Economic Outlook (April 2018), with Haiti, Gabon, Rwanda, Sierra Leone, and Moldova manually classified as developing economies.

Columns (4) and (5) of Table A.2 report the results for advanced and developing economies, respectively. In both groups, productivity is more resilient following sudden stops under fixed exchange rate regimes than under more flexible arrangements. This indicates that the baseline relationship between exchange rate flexibility and productivity dynamics is not driven by the composition of the sample across development levels.

Controlling for the Type of Crisis Sudden stops may also differ depending on the geographic scope of the crisis in which they occur. To account for this dimension of heterogeneity, I classify sudden stops as local, regional, or global depending on whether regional or global GDP growth is negative at any point between one year before and one year after the onset of the episode ($t = 0$). Global and regional GDP growth rates are taken from the IMF World Economic Outlook.

Columns (6)–(8) of Table A.2 report the corresponding results for local, regional, and global crises, respectively. To preserve statistical power, currency unions and hard pegs are grouped together, as are soft pegs and floating arrangements. Across all three categories, the relative response of productivity across exchange rate regimes closely mirrors the baseline results. This indicates that the relationship between exchange rate flexibility and productivity dynamics during sudden stops is not driven by whether the associated crisis is local, regional, or global.

B Firm-level Data

B.1 Evolution of Aggregate Productivity in Spain

This appendix provides background and clarification on the evolution of aggregate productivity in Spain during the period considered in the paper. It addresses concerns regarding the choice of data sources, pre-sudden stop trends, and the comparison with manufacturing TFP.

Alternative data sources Panel A of Figure A.5 shows that all five leading aggregate TFP data sources point to an increase in TFP relative to trend during 2010–13, despite differing views on the behavior of TFP in levels. While AMECO and, to a lesser extent, the OECD suggest a stabilization or mild increase in aggregate TFP over this period, other sources—such as EU KLEMS, the Conference Board, and the Penn World Tables—continue to show declining levels, albeit at a slower pace. Crucially, once TFP is evaluated relative to its pre-crisis trend, the implied deviation during the sudden stop is positive across all sources.

Discrepancies in levels reflect differences in underlying data and methodological choices. AMECO and OECD rely on standard growth-accounting measures of TFP constructed as Solow residuals from real GDP and factor input shares. EU KLEMS incorporates more granular adjustments for factor composition and utilization. The Conference Board and Penn World Tables adopt alternative aggregation and comparison methods, including two-period averaging and international Törnqvist index constructions. Given its transparency, standardization, and policy relevance in the European context, AMECO serves as the benchmark series in the main text.

Pre-sudden stop trend in productivity Throughout the paper, aggregate variables are analyzed relative to their pre-crisis long-term trends. This follows the established convention in the sudden stop literature, where the focus is on how financial crises disrupt existing trajectories rather than on levels.

In the case of the 2010–13 episode, aggregate productivity was already on a declining path. For the 1992–93 episode, although official statistics are only available from 1995 onward, historical evidence suggests a similar pattern: Prados De la Escosura (2017) documents a stalling of productivity growth as early as the mid-1980s. If productivity was falling prior to both episodes, the relevant contrast lies in how TFP behaved relative to trend when each sudden stop hit.

Total economy vs. manufacturing TFP The baseline series used in the introduction refers to the total economy. However, the rest of the paper, particularly the firm-level analysis, focuses on manufacturing firms. Panel B of Figure A.5 compares the evolution of Spanish TFP in the total economy with that in the manufacturing sector over the years for which data are available and confirms that the trends are broadly similar.

B.2 Comparability of Episodes

This appendix discusses differences in Spain's economic structure and policy environment across the 1992–93 and 2010–13 sudden stops and argues why they are unlikely to overturn the interpretation of the main results.

Long-run shifts in the manufacturing sector. The importance of manufacturing in aggregate activity declined markedly between the early 1990s and the late 2000s: its share in GDP fell from around 20% in the early 1990s to roughly 12% by 2009. Since the firm-level analysis focuses on manufacturing, this decline does not directly affect the sample. It does, however, have implications for the strength of aggregate income effects generated by shocks to manufacturing. With a smaller manufacturing sector in 2010–13, shocks to manufacturing should exert weaker feedback on aggregate demand than in 1992–93. If anything, this weaker amplification would tend to reduce firm exit in the later episode, working against the patterns documented rather than in favor of them.

At the same time, there is no evidence of large changes in the *composition* of manufacturing across the two episodes. Table A.3 reports the evolution of the shares of output and the wage bill across two-digit manufacturing sectors between 1993 and 2007 using data from the Spanish National Institute of Statistics (INE).[2] The sectoral distribution remains relatively stable over time. In the firm-level regressions, industry fixed effects absorb systematic differences in exit rates across sectors, while industry-by-year fixed effects account for changes in the relative importance of different industries over time.

The construction boom and bust. The burst of the 2000s property bubble in 2008 might appeal to the reader as an alternative explanation for the sharp rise in firm exit during the 2010–13 crisis. The analysis addresses this concern in two ways. First, the ESEE dataset abstracts from the construction sector altogether, so the firm-level sample is not directly contaminated by the collapse in construction activity. Second, industry-by-year fixed effects mitigate concerns that manufacturing firms might be differentially exposed to construction through input–output linkages, by controlling flexibly for time-varying shocks at the industry level.

Union-wide policies and TARGET2. A further concern is that European policymakers responded to the 2010–13 sudden stop with a range of union-wide policies that were not available during the 1992–93 episode. In particular, the buildup of TARGET2 imbalances is widely regarded as a particularly effective policy tool. TARGET2, the Eurozone's payment system, allowed national central banks within the Eurosystem to extend credit that replaced reduced private inflows with public

[2] Unfortunately, 1993 is the earliest year for which disaggregated data are available, and the aggregation is at the two-digit level, whereas the firm-level analysis is conducted at the three-digit level.

funds, thereby cushioning the deleveraging shock during the 2010–13 crisis. The availability of these tools reflects the institutional framework of a currency union and distinguishes it from a standard fixed exchange-rate regime.[3] For the purposes of this paper, what matters most is that, if such policies indeed mitigated the shock in 2010–13, the observed patterns should be interpreted as a *lower bound* on the selection at exit induced by a sudden stop under a currency union.

Net foreign asset position. Spain entered the 2010–13 episode with a notably weaker external balance sheet than in the early 1990s: its net international investment position was roughly –20% of GDP in the mid-1990s, compared with close to –90% of GDP on the eve of the second sudden stop according to Eurostat. This more negative external position implies greater exposure to foreign shocks and could, in principle, intensify the contractionary effects of a sudden stop in 2010–13. However, this type of vulnerability should operate primarily through firms' balance sheets—via tighter credit conditions, greater reliance on external funding, or higher leverage—and would therefore be absorbed by the debt-to-assets control in Table IV.

A related concern is that the composition of external liabilities also changed over time. Data from the Bank of Spain indicates that inward FDI liabilities rose from roughly 15–20% of GDP in the mid-1990s to 41.6% of GDP in 2008. Crucially, however, this expansion occurred primarily in finance, real estate, energy, and telecommunications, rather than in manufacturing. Sectoral FDI statistics confirm that the manufacturing share of inward FDI remained modest and broadly stable over this period. The ESEE data reflect the same pattern: foreign ownership within Spanish manufacturing is limited, stable, and shows no meaningful shift across the two episodes. Moreover, multinational affiliates generally rely on internal capital markets and tend to exhibit lower exit rates during credit tightening. Taken together, these facts suggest that shifts in external liability composition are not a plausible driver of the episode-specific differences in exit.

B.3 Data Cleaning, Definition of Variables and Deflating Nominal Measures

This appendix describes the data cleaning procedure, the definition of specific variables in the final dataset and the use of price deflators. Regarding the former, I only leave out firms that report zero or negative values of value added or capital stock. Note that I drop the entire firm record, instead of the corresponding firm-year observation. This is to prevent firms disappearing (and maybe then reappearing) in the sample strictly due to the cleaning procedure, which is vital to correctly capture entry and exit to the market. The efforts devoted to ensure consistency and accuracy during the ESEE data collection process minimize the loss of observations resulting from this requirement.

Regarding the latter, I measure real output as nominal value added divided by an output price

[3]However, the model in Section 4 does not capture these institutional differences and treats fixed exchange-rate regimes and currency unions equivalently.

deflator. Obtaining an appropriate industry-specific output price deflator series is challenging for two reasons. First, the data needs to go back in time at least until 1990, while Eurostat series, the standard source, only start around 2000. Instead, I use the producer price index provided by the Spanish National Statistics Institute (NSI) at the three-digit industry level. Second, the ESEE provides its own industry classification that maps NACE Rev.2 codes to 20 manufacturing industries. Given that the mapping is not strictly one-to-one, deriving corresponding industry-specific deflators requires implementing a weighting strategy.[4] My approach is to use sector contribution to total manufacturing value added in 2018, also provided by the NSI, as the relevant weight.[5]

I follow the literature in using the wage bill, deflated by the above price series, instead of employment to measure the labor input, in order to control for heterogeneity in labor quality across firms. To measure capital stock I use two different variables given existing data restrictions: for the 1990-1999 period I use total real net capital stock whereas for the 2000-2014 period I use the book value of fixed assets deflated by the price of investment goods from the Spanish National Statistics Institute.[6,7]

B.4 TFP Growth Decomposition

This appendix derives the TFP growth decomposition specification used in Table II. Define aggregate productivity, Z_t, as a weighted average of firm-level TFP. Given that the focus is on firm dynamics, I express overall aggregate productivity as the weighted sum of the aggregate productivities of incumbents, Z_t^C, entrants, Z_t^N, and exiters, Z_t^X,

$$Z_t \equiv \sum_{i \in N_t} s_{i,t} Z_{i,t} = s_t^C Z_t^C + s_t^N Z_t^N + s_t^X Z_t^X ,$$

where $s_{i,t}$ is the employment share of firm i and N_t the total number of firms in the economy, both at time t. In addition, s_t^j is the total employment share and $Z_t^j \equiv \sum_{i \in j} s_{i,t}^j Z_{i,t}^j$ is the aggregate productivity of firms pertaining to group j, where $s_{i,t}^j = s_{i,t}/s_t^j$ and $j = \{C, N, X\}$.

The variable of interest is the change in aggregate productivity from period $t-1$ to period t, ΔZ_t. It follows that the relevant groups for the analysis are: incumbents in both periods, firms exiting at period $t-1$ and firms entering in period t. This implies that $s_{t-1}^N = s_t^X = 0$. By exploiting

[4]For example, manufacturing industry with ESEE code 7 (paper) corresponds to NACE Rev.2 codes 171 and 172.

[5]The NSI provides weightings for the 2010-2018 period only. I use 2018 figures, as opposed to taking an average or an alternative year, because 2018 is the only year for which there are no missing values.

[6]Total real net capital stock is defined as the value of the stock of total net capital at 1990 constant prices which I simply convert into base year (2015) prices.

[7]I conduct several robustness exercises in order to check whether the change in the capital stock measure has an impact on the results. First, for the years for which the two series overlap, 1993-1999, I estimate that the correlation coefficient at the firm-level is 0.9. Second, for the 1993-1999 period, I estimate the production function using the two series separately and then compare resulting coefficients - for 18 out of 20 industries the differences are of magnitude ± 0.5 on average. Finally, I redo the analysis splitting the sample before and after 1999 such that the two series do not interact in any way during the production function estimation stage.

the fact that $s^C_{t-1} + s^X_{t-1} = 1$ and $s^C_t + s^N_t = 1$ and using the expression above, I can rewrite the change in aggregate productivity as

$$\Delta Z_t = Z^C_t - Z^C_{t-1} + s^N_t \left(Z^N_t - Z^C_t \right) - s^X_{t-1} \left(Z^X_{t-1} - Z^C_{t-1} \right) .$$

The interpretation of the above decomposition partly coincides with that of Melitz and Polanec (2015): entrants (exiters) contribute positively to TFP growth when their average productivity is higher (lower) than the incumbents' counterpart. These contributions are weighted by the employment share of entrants, s^N_t, and exiters, s^X_{t-1}, respectively.[8] I abstract, however, from decomposing the contribution of incumbents further using Olley and Pakes (1996)'s approach.[9] Instead, I follow Dias and Marques (2021) in tracking individual incumbent firms over time so that I can distinguish between the contributions of firm-level productivity growth and employment share reallocation among them.

Given the definition of Z^C_t, the change in aggregate productivity can be further decomposed as:

$$\Delta Z_t = \sum_{i \in C} s^C_{i,t-1} \Delta Z_{i,t} + \sum_{i \in C} Z_{i,t-1} \Delta s^C_{i,t} + \sum_{i \in C} \Delta s^C_{i,t} \Delta Z_{i,t} + s^N_t \left(Z^N_t - Z^C_t \right) - s^X_{t-1} \left(Z^X_{t-1} - Z^C_{t-1} \right) .$$

The contribution by incumbents maps exactly into that in Foster, Haltiwanger and Krizan (2001). The first term measures the contribution of within-firm productivity changes of incumbents weighted by their initial share. The second term captures the contribution of market share reallocation. The third term is known as the cross-effect, it is the covariance of market share and productivity changes for the individual firm.

B.5 Robustness

B.5.1 Differences in Crisis Duration

As already mentioned, a notable difference across the two sudden stops discussed is the length of each of these crises. This could be particularly problematic in a world in which firms postponed their decision to shut down, incurring negative profits, until they are unable to roll on credit any

[8] This version differs from the widely used Foster, Haltiwanger and Krizan (2001) decomposition in allowing for differences in the reference productivity for entrants, exiters and incumbents. Intuitively, the contribution of entrants (exiters) is now equal to the change in productivity one would observe if entry (exit) was elided. Moreover, it has a direct mapping into a theoretical model of firm productivity heterogeneity, circumventing the recent criticism to accounting exercises measuring reallocation posed by Hsieh and Klenow (2017).

[9] Olley and Pakes (1996) would simply set:

$$Z^C_t - Z^C_{t-1} = \Delta \bar{Z}^C_t + \Delta\, Cov \left(s^C_{i,t}, Z^C_{i,t} \right) .$$

further. Under this assumption, it can be argued that the observed larger contribution of exit during the 2010-13 is a mechanical effect of its duration. In other words, if the 1992-93 crisis had been longer, more unproductive firms would have exited the market.

To address this concern directly, this appendix compares the decomposition of productivity growth during the first sudden stop with an analogous decomposition for the second sudden stop—that is, a window of equal length to the earlier crisis. Table A.8 reports the contribution of incumbents, entrants, and exiters to aggregate productivity growth over these matched horizons (1992-93 versus 2010-11).

The results indicate that aligning the length of the two episodes does not alter the central conclusions. In both crises, productivity at the firm level is procyclical, generating a negative within-firm contribution. In the earlier episode this within-firm decline dominates, whereas in the later episode it is neutralized by positive reallocation forces, i.e., the between-firm and cross-terms. As a result, the cumulative increase in aggregate TFP over 2010–11 is slightly larger than when considering the full window.

The main qualitative difference across episodes—the strength of the composition effect—remains. Although the contribution of exiters is somewhat smaller over 2010–11 than in the full episode, it is still more than twice the size of the exit contribution during 1991–93. Moreover, in the shorter window, the net entry contribution remains positive and continues to be the main driver of aggregate productivity growth overall. Hence, the stronger role of exit in the later sudden stop cannot be fully attributed to its longer duration.

B.5.2 TFP Growth Decomposition

Alternative Decompositions There are two types of productivity decomposition exercises performed by the existing literature. The first involves following firms over time, tracking their changes to both shares and productivity: Baily et al. (1992), Griliches and Regev (1995), Foster, Haltiwanger and Krizan (2001). Alternatively, Olley and Pakes (1996) propose a decomposition based on moments of the joint distribution of market shares and productivity, which Melitz and Polanec (2015) extend to accommodate entry and exit. As explained above, I choose to combine Foster, Haltiwanger and Krizan (2001) and Melitz and Polanec (2015) to capture the best of both approaches.

Table A.9 shows that the key take-aways are robust to either type of original decompositions. Columns (4) and (5) correspond to the Foster, Haltiwanger and Krizan (2001) decomposition: the increase in TFP in the 2010-13 sudden stop is driven by substantial exit of unproductive firms and reallocation of shares towards more productive incumbents. This cleansing mechanism fully offsets the decline in firm-level productivity as in the baseline decomposition. Columns (6) and (7) correspond to the Melitz and Polanec (2015) decomposition, which only differs from the baseline on the break-down of the incumbents' contribution. In both episodes we observe a sizable leftward shift in the productivity distribution of incumbents, but only the latter features a positive market share covariance in line with cleansing, cushioning the negative contribution of incumbents to overall productivity growth.

Alternative Weights Table A.10 presents the results for the TFP growth decomposition exercise in the main text, but aggregating TFP using alternative weights: value-added and sales. It is still the case, that the fall in TFP during the 1992-93 episode is driven mainly by the behavior of incumbents and, more specifically, by the decline in within-firm productivity. The contribution of net entrants, in particular the exit of unproductive firms, is still the main driver of productivity growth during 2010-13. The only difference is the negative between-firm contribution. However, it is compensated by a large positive covariance between productivity and market share changes at the firm level such that the overall negative contribution of incumbents during the latter period is dampened. All in all, key results hold when aggregating TFP using value-added or sales.

B.5.3 An Alternative Case Study Using Orbis

The ORBIS global company database, compiled by Bureau van Dijk, has become the leading source for firm-level analysis due to its extensive coverage. Crucially for this analysis, ORBIS collects information on micro-firms (those with fewer than 10 employees) and significantly enhances the coverage of small and medium-sized enterprises (SMEs) within the Spanish manufacturing sector. However, its time coverage begins only in the late 1990s, restricting its use to the 2010–2013 sudden stop, for which I can rerun the analysis using this alternative dataset.

My strategy is to identify a different sudden stop suitable for a case study under a floating exchange rate regime. To do so, I search among the episodes detected by the algorithm in Section 6 (see Table A.1) for those that (i) occurred under a floating regime and (ii) exhibit adequate manufacturing sector coverage in ORBIS, as documented by Kalemli-Özcan et al. (2024). The Czech Republic's sudden stop during 2011–2013 emerges as an ideal candidate. Beyond the availability of comparable micro data, this episode unfolded in a similarly advanced economy and within a comparable time frame. As in the case of Spain's 1992–1993 sudden stop, aggregate TFP declined markedly, by roughly 4%.

Tables A.12 and A.13 confirm the presence of a cleansing effect during Spain's 2010–2013 sudden stop, which is notably absent during the Czech Republic's 2011–2013 episode. According to ORBIS data, aggregate TFP increases by nearly 9% in Spain but falls by 7% in the Czech Republic. In both cases, the decomposition of TFP changes reveals two common features: (i) a negative within-firm productivity component and (ii) a significant role for net entry. In Spain, the exit of unproductive firms accounts for three-quarters of total TFP growth, while entrants contribute negatively, though only marginally. In contrast, the Czech episode is characterized by both entry and exit exerting negative effects on aggregate TFP, with the negative contribution from entrants playing a more prominent role.

The regression results echo these patterns. The Spanish sudden stop is marked by a strengthening of selection: the negative correlation between firms' propensity to exit and their productivity intensifies. In the Czech Republic, however, selection weakens during the sudden stop—firm exits become less closely related to productivity. While ORBIS lacks information on firms' participation in international trade—preventing me from testing several alternative channels discussed in the main text—Table A.14 shows that controlling for firms' financial health does not alter the magnitude or stability of the key productivity coefficients.

Despite focusing on a different episode and dataset, this new case study confirms the key asymmetry in firm behavior highlighted in the baseline analysis. Firm dynamics during sudden stops differ systematically depending on the exchange rate regime: selection operates more strongly under a currency union than under a flexible exchange rate regime.

C Model Details

C.1 Robustness: Preferences and Imported Inputs

This appendix examines the robustness of Proposition 1 to two extensions of the baseline model: CES preferences and imported intermediate inputs. In both cases, the focus is on how these extensions modify the channels through which shocks affect the domestic productivity threshold.

CES preferences. Suppose household preferences feature a Dixit–Stiglitz aggregator over consumption varieties,

$$Q_t = \left[\int_{j \in \Omega} q_{jt}^{\frac{\eta-1}{\eta}} \, dj \right]^{\frac{\eta}{\eta-1}}, \qquad \eta > 1,$$

and firms face a fixed operating cost f in nominal terms. Profit maximization implies a constant markup over marginal cost,

$$p_t(z) = \frac{\eta}{\eta - 1} \frac{W_t^{\sigma}}{Z_t z}.$$

The zero-profit condition for the marginal firm, $\pi_t(z_t^H) = 0$, yields the productivity threshold

$$Z_t z_t^H = \frac{\eta}{\eta - 1} \left(\frac{k + 1 - \eta}{k} \right)^{\frac{1}{\eta-1}} \frac{\lambda_t W_t^{\sigma}}{N_t^{\frac{1}{\eta-1}}}, \tag{9}$$

where N_t denotes the number of active varieties and the expression exploits the fact that average revenue per firm is pinned down by parameters under CES preferences.

Setting $Z_t = 1$ and totally differentiating (9) delivers the following result.

Proposition 3. *In the stationary equilibrium with CES preferences,*

$$dz_t^H = \underbrace{G_N\, dN_t}_{\textit{Varieties}} + \underbrace{G_W\, dW_t}_{\textit{Cost}} + \underbrace{G_\lambda\, d\lambda_t}_{\textit{Demand}},$$

where $G_N < 0$, $G_W > 0$, and $G_\lambda > 0$.

Relative to the baseline model, all three channels remain operative. A key difference is that an increase in the number of varieties lowers the productivity threshold. This reflects the homotheticity of CES preferences, which keeps relative revenue shares constant and implies that expanding the mass of firms raises total revenue without tightening competition at the firm level.

Imported intermediate inputs. Next, suppose firms produce using labor and intermediate inputs, $q_t(z) = z\, l_t(z)^\sigma x_t(z)^{1-\sigma}$, where intermediates are assembled from domestic and foreign varieties,

$$x_t(z) = \left[\left(x_t^H(z)\right)^{\frac{\chi-1}{\chi}} + \left(\Upsilon x_t^F(z)\right)^{\frac{\chi-1}{\chi}} \right]^{\frac{\chi}{\chi-1}}.$$

The effective price of intermediates is

$$p_t^I = W_t \left[1 + \Theta_t^{\chi-1} \right]^{\frac{1}{1-\chi}}, \qquad \Theta_t \equiv \frac{\Upsilon W_t}{e_t},$$

so unit production costs depend on both wages and the price-adjusted quality advantage of foreign inputs.

The zero-profit condition for the marginal firm implies the threshold

$$Z_t z_t^H = \frac{\lambda_t W_t \left[1 + \Theta_t^{\chi-1} \right]^{\frac{1}{1-\chi}}}{\alpha\gamma} \left[\gamma + \frac{\eta}{2k+2} N_t \right]. \tag{10}$$

Setting $Z_t = 1$ and totally differentiating (10) yields the following decomposition.

Proposition 4. *In the stationary equilibrium with imported intermediate inputs,*

$$dz_t^H = \underbrace{H_N\, dN_t}_{\textit{Varieties}} + \underbrace{H_W\, dW_t}_{\textit{Cost}} + \underbrace{H_\Theta\, d\Theta_t}_{\textit{Foreign Quality}} + \underbrace{H_\lambda\, d\lambda_t}_{\textit{Demand}},$$

where $H_N > 0$, $H_W > 0$, $H_\Theta < 0$, and $H_\lambda > 0$.

The foreign quality channel operates as the inverse of a foreign cost channel: an increase in Θ_t lowers effective production costs and relaxes the productivity threshold. Since Θ_t decreases during a sudden stop under both exchange-rate regimes, this channel tightens the threshold in both cases. While conceptually interesting, it is not incorporated into the quantitative model, as imported intermediates are used by a subset of firms and appear empirically less relevant for exit dynamics.

C.2 Computation of the Steady State

This appendix outlines the computation of the model without aggregate shocks. I omit the notation on Z_t as its constant and equal to one here.

1. Set discrete grids on z^T. Set the Markov transition matrix for z^T. Set the distribution of the exit value x.

2. Guess for p^{max}.

3. For a given p^{max}, guess for W. Solve for $\lambda = \frac{\varepsilon_w}{\varepsilon_w - 1}\frac{1}{W}$ as well as $p^k(\tilde{\mu}, z^P, z^{T\prime}), q^k(\tilde{\mu}, z^P, z^{T\prime})$ and $\pi^k(\tilde{\mu}, z^P, z^{T\prime})$, for $k = \{H, X, M\}$ and $z^P = \{z^L, z^H\}$, where $z^{T\prime}$ is the realization of transitory productivity in the current period and $\tilde{\mu} = \{W, p^{max}\}$.

4. Optimization loop. Objects: $V(\tilde{\mu}, z^P, z^T)$, $V^c(\tilde{\mu}, z^P, z^{T\prime})$, and $\chi(\tilde{\mu}, z^P, z^T)$. For each $z^P = \{z^L, z^H\}$:

   (a) Start with an initial value for $V(\tilde{\mu}, z^P, z^T)$. This is the beginning-of-period value for an incumbent.

   (b) Calculate $V^c(\tilde{\mu}, z^P, z^T)$ by

   $$V^c(\tilde{\mu}, z^P, z^{T\prime}) = \begin{cases} \pi(\tilde{\mu}, z^P, z^{T\prime}) + \beta V(\tilde{\mu}, z^P, z^{T\prime}) & \text{if } \pi(\tilde{\mu}, z^P, z^{T\prime}) > 0 \\ 0 & \text{otherwise} \end{cases}$$

   (c) Calculate $V(\tilde{\mu}, z^P, z^T)$ by

   $$V(\tilde{\mu}, z^P, z^T) = \int \max\left\{ E_z\left[V^c(\tilde{\mu}, z^P, z^{T\prime}) \Big| z^T \right], x \right\} d\xi(x),$$

   where

   $$E_z\left[V^c(\tilde{\mu}, z^P, z^{T\prime}) \Big| z^T \right] = \int V^c(\tilde{\mu}, z^P, z^{T\prime})\ dH\left(z^{T\prime} | z^T\right).$$

   Thus, the ratio of firms that exit with the state z is

   $$\chi(\tilde{\mu}, z^P, z^T) = \int_{E_z\left[V^c(\tilde{\mu}, z^P, z^{T\prime}) | z^T\right]}^{\infty} d\,\xi(x).$$

   (d) Update and repeat.

5. For each $z^P = \{z^L, z^H\}$, I can now calculate

   $$V^e(\tilde{\mu}, z^P, s) = \int V^c(\tilde{\mu}, z^P, z^{T\prime})\ dH^s\ (z^{T\prime} | s),$$

for each s and solve for the cutoff $s^*(z^P)$ by setting $V^e(\tilde{\mu}, z^P, s^*(z^P)) = c_e$.

The measure of entrants for unit M^s is given by:

$$g(\tilde{\mu}, z^P, z^{T'}) = \int_{s^*(z^P)}^{\infty} \mathbf{1}\{\pi(\tilde{\mu}, z^P, z^{T'}) \geq 0\} H^s(z^{T'}|s)\, dS(s)\,.$$

6. Next, find

$$V^p(\tilde{\mu}) = \int \int \max\left\{V^e(\tilde{\mu}, z^P, s) - c_e,\, 0\right\}\, dS(s)\, dF(z^P)\,.$$

   Check if free-entry condition is satisfied: $V^p(\tilde{\mu}) = c_s$. If not, revise the guess for W in the third step. Repeat until convergence.

7. Calculate the stationary measure of operating domestic firms (last period's survivors plus current period's entrants, after receiving idiosyncratic shock, $\gamma(\tilde{\mu}, z^P, z^{T'})$, given $M^s = 1$:

$$\gamma(\tilde{\mu}, z^P, z^{T'}) = \int H(z^{T'}|z^T)(1 - \chi(\tilde{\mu}, z^P, z^T))\gamma(\tilde{\mu}, z^P, z^T)\, dz^T + g(\tilde{\mu}, z^P, z^{T'})\,.$$

   From linear homogeneity, the actual measure of operating firms will be $M^s\gamma(\tilde{\mu}, z^P, z^{T'})$.

8. Obtain M^s by exploiting goods market clearing. In particular

$$M^s = \frac{\int p^M(\tilde{\mu}, z) q^M(\tilde{\mu}, z) d\Gamma^*(z)}{\int e\, p^X(\tilde{\mu}, z) q^X(\tilde{\mu}, z)\gamma(\tilde{\mu}, z) dz}\,.$$

9. Finally, calculate the implied $p^{max}_{implied}$ as

$$p^{max}_{implied} = \frac{\frac{\alpha\gamma}{\lambda} + \eta P}{\gamma + \eta N}\,,$$

   where

$$P = M^s \int p^H(\tilde{\mu}, z)\, \mathbf{1}\{\pi^H(\tilde{\mu}, z) \geq 0\}\, \gamma(\tilde{\mu}, z)\, dz + \int p^M(\tilde{\mu}, z)\, \mathbf{1}\{\pi^M(\tilde{\mu}, z) \geq 0\}\, d\Gamma^*(z)\,,$$

   and

$$N = M^s \int \mathbf{1}\{\pi^H(\tilde{\mu}, z) \geq 0\}\, \gamma(\tilde{\mu}, z)\, dz + \int \mathbf{1}\{\pi^M(\tilde{\mu}, z) \geq 0\}\, d\Gamma^*(z)\,.$$

10. Compare $p^{max}_{implied}$ with the guess in the second step, p^{max}. If they are not close enough, revise the guess and repeat until convergence.

C.3 Computation of Model with Aggregate Shocks

This appendix outlines the computation of the model with aggregate shocks. Consider an economy that starts from the stochastic steady state described above. Agents have perfect foresight but are surprised by unexpected shocks to Z_t and R_t at $t = 0$, which agents take as transitory and evolving as AR(1) processes from $t > 0$.

1. Set discrete grids on z^T. Set the Markov transition matrix for z^T. Set the distribution of the exit value x.

2. Choose a time T at which point the economy has reached steady state. For $t \geq T$, $\epsilon_t \lambda_t = \lambda^{ss}$. For $t < T$, solve for $\epsilon_t \lambda_t$ backwards, using the Euler condition.

3. Guess a path for $\{W_t\}_{t=0}^{T-1}$. Note that $W_t = W^{ss}$ for $t \geq T$.

4. Solve for ϵ_t using the monetary policy rule.

5. Solve for λ_t given the solution to $\epsilon_t \lambda_t$ in step 2.

6. For each $t = T-1, T-2, \ldots, 0$, guess a value for p_t^{max}:

    (a) Solve for $p_t^k(\mu_t, z), q_t^k(\mu_t, z)$ and $\pi_t^k(\mu_t, z)$, for $k = \{H, X, M\}$ and $z^P = \{z^L, z^H\}$, where $z = z^P z^{T'}$ is the idiosyncratic productivity realization in the current period and $\mu_t = \{W_t, p_t^{max}, Z_t\}$.

    (b) Calculate $V_t^c(\mu_t, z^P, z^{T'})$ by

    $$V_t^c(\mu_t, z^P, z^{T'}) = \begin{cases} \pi_t(\mu_t, z^P, z^{T'}) + \beta V_{t+1}(\mu_{t+1}, z^P, z^{T'}) & \text{if } \pi_t(\mu_t, z^P, z^{T'}) \geq 0\,, \\ 0 & \text{otherwise }. \end{cases}$$

    (c) Calculate $V_t(\mu_t, z^P, z^T)$ by

    $$V_t(\mu_t, z^P, z^T) = \int \max\left\{E_z\left[V_t^c(\mu_t, z^P, z^{T'})\Big| z^T\right], x\right\} d\,\xi(x)\,,$$

    where

    $$E_z\left[V_t^c(\mu_t, z^P, z^{T'})\Big| z^T\right] = \int V_t^c(\mu_t, z^P, z^{T'})\; dH\,(z^{T'}|z^T)\,.$$

    Thus, the ratio of firms that exit with the state z is

    $$\chi_t(\mu_t, z^P, z^T) = \int_{E_z\left[V_t^c(\mu_t,, z^P, z^{T'})|z^T\right]}^{\infty} d\,\xi(x)\,.$$

    (d) Now I can calculate

    $$V_t^e(\mu_t, z^P, s) = \int V_t^c(\mu_t, z^P, z^{T'})\; dH^s\;(z^{T'}|s)\,,$$

    for each s and solve for the cutoff $s_t^*(z^P)$ by setting $V_t^e(\mu_t, z^P, s_t^*(z^P)) = c_e$.

The measure of entrants is given by:

$$g_t(\mu_t, z^P, z^{T'}) = \int_{s_t^*(z^P)}^{\infty} \mathbf{1}\{\pi_t(\mu_t, z^{T'}) \geq 0\} H^s(z^{T'}|s)\, dS(s)\,.$$

(e) Next, find

$$V_t^p(\mu_t) = \int\int \max\left\{V_t^e(\mu_t, z^P, s) - c_e, 0\right\}\, dS(s)\, dF(z^P)\,.$$

(f) Check if free-entry condition is satisfied: $V_t^p(\mu_t) = c_s$. If not, revise the guess for p_t^{max}. Repeat until convergence.

7. Starting from the steady state distribution, simulate the measure of operating domestic firms forward.

   (a) The measure of incumbents operating is:

   $$\delta_t(\mu_t, z) \equiv \delta_t(\mu_t, z^P, z^{T'}) = H(z^{T'}|z^T)(1 - \chi_t(\mu_t, z^P, z^T))\gamma_{t-1}(\mu_{t-1}, z^P, z^T)\,.$$

   (b) The measure of operating domestic firms is

   $$\gamma_t(\mu_t, z^P, z^{T'}) = \delta_t(\mu_t, z^P, z^{T'}) + M^s\, g_t(\mu_t, z^P, z^{T'})\,.$$

8. Calculate aggregate employment as

$$L_t = \int\int l_t(\mu_t, z)\, \gamma_t(\mu_t, z^P, z^{T'})\, dz^{T'}\, dz^P \quad \text{where} \quad l_t(\mu_t, z) = \frac{W_t^{\sigma-1}}{Z_t z}\left(q_t^H(\mu_t, z) + \tau q_t^M(\mu_t, z)\right)\,.$$

9. Calculate W_t^* as

$$W_t^* = \frac{\varepsilon_w}{\varepsilon_w - 1}\frac{\sum_{s=0}^{\infty}(\beta\theta)^s W_{t+s}^{\varepsilon_w} L_{t+s}}{\sum_{s=0}^{\infty}(\beta\theta)^s W_{t+s}^{\varepsilon_w} L_{t+s}\lambda_{t+s}}\,.$$

10. Finally, calculate $W_t^{implied}$ from the aggregate wage dynamics equation:

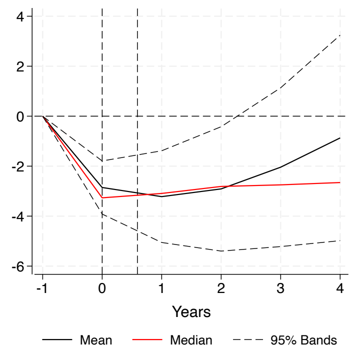
$$W_t^{implied} = \left[\theta(W_{t-1}^{implied})^{1-\epsilon_w} + (1-\theta)(W_t^*)^{1-\epsilon_w}\right]^{\frac{1}{1-\epsilon_w}}\,.$$

11. Compare $\{W_t^{implied}\}_{t=0}^{T-1}$ with the guess in the third step, $\{W_t\}_{t=0}^{T-1}$. If they are not close enough, revise the guess and repeat until convergence.

12. Check whether the economy has indeed reached steady state at time T.

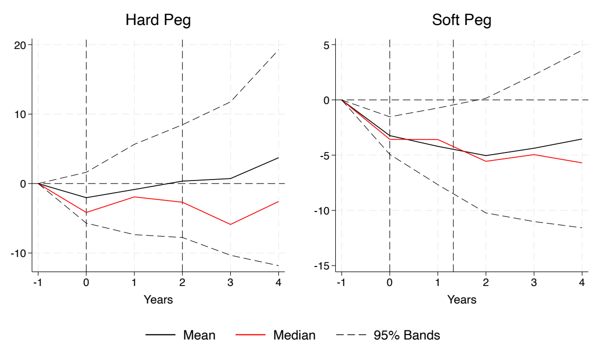
D Additional Figures

FIGURE A.1: PRODUCTIVITY DURING A SUDDEN STOP - ALL EPISODES



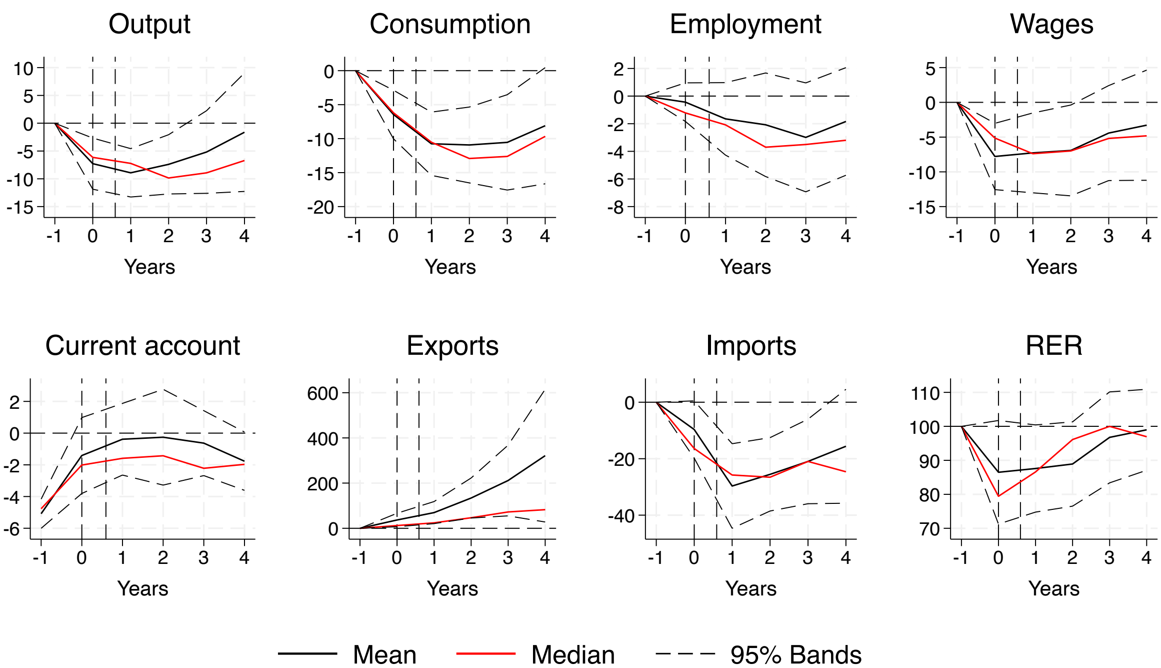
Notes: This figure plots the response of TFP to a sudden stop. The black and red solid lines depict the mean and median path of productivity while the black dashed lines represent standard error bands. The two vertical lines show the start and end of an average episode. Productivity is expressed as percentage deviations from an extrapolated linear trend fitted over the five-year pre–sudden-stop window. The data used is collected from IFS, WDI and the Total Economy Database.

FIGURE A.2: PRODUCTIVITY DURING A SUDDEN STOP - HARD VERSUS SOFT PEGS



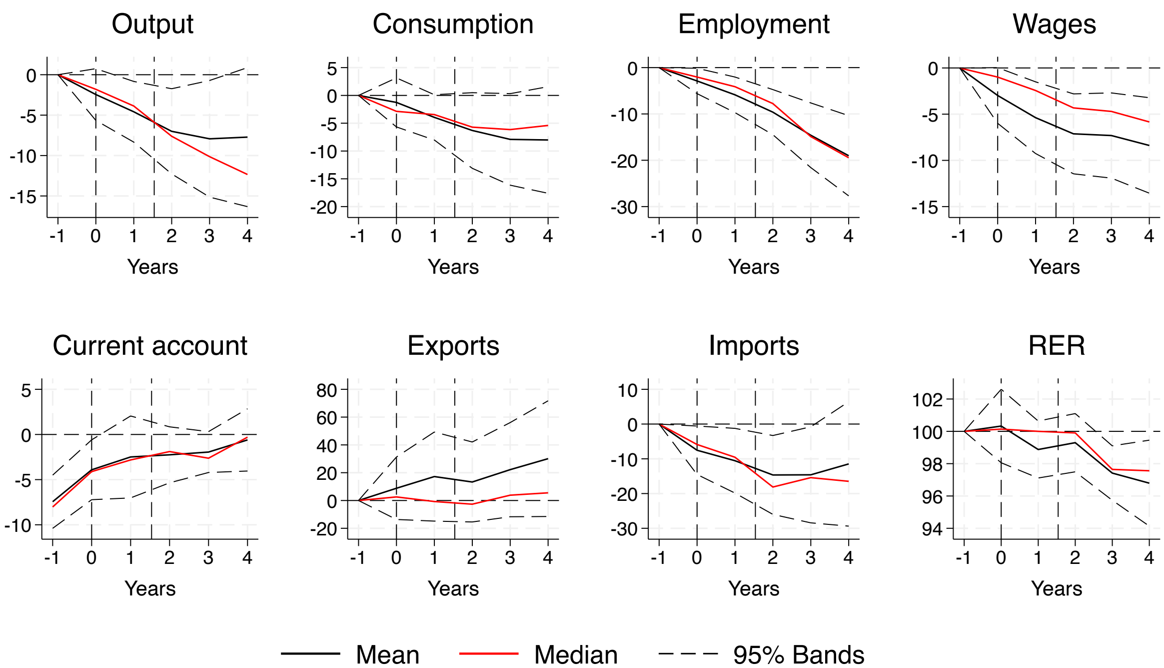
Notes: This figure plots the response of TFP to a sudden stop under a hard peg (left) and under a soft peg (right). The black and red solid lines depict the mean and median path of productivity while the black dashed lines represent standard error bands. The two vertical lines show the start and end of an average episode. Productivity is expressed as percentage deviations from an extrapolated linear trend fitted over the five-year pre–sudden-stop window. The data used is collected from IFS, WDI and the Total Economy Database.

FIGURE A.3: A SUDDEN STOP IN A FLOATING ARRANGEMENT



Notes: This figure plots the response of macroeconomic variables to a sudden stop under a floating arrangement. The black and red solid lines depict the mean and median path of the corresponding variables while the black dashed lines represent standard error bands. The two vertical lines show the start and end of an average episode. Output, consumption, employment, wages, exports and imports are expressed in terms of percentage deviations from an extrapolated linear trend fitted over the five-year pre–sudden-stop window. Current account is expressed as a share of GDP and the real exchange rate (RER), calculated as an index, is expressed in levels. The data used is collected from IFS, WDI and the Total Economy Database.

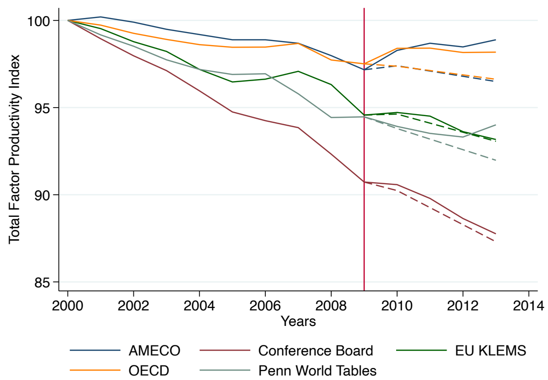
FIGURE A.4: A SUDDEN STOP IN A CURRENCY UNION



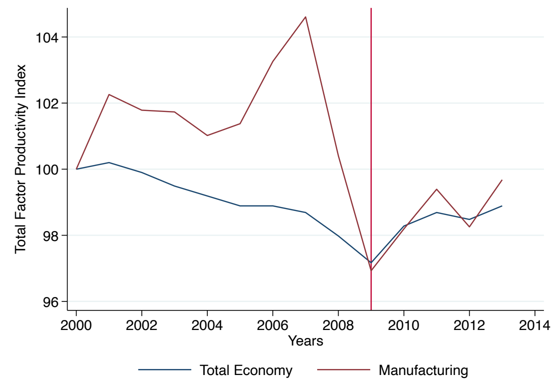
Notes: This figure plots the response of macroeconomic variables to a sudden stop under a currency union. The black and red solid lines depict the mean and median path of the corresponding variables while the black dashed lines represent standard error bands. The two vertical lines show the start and end of an average episode. Output, consumption, employment, wages, exports and imports are expressed in terms of percentage deviations from an extrapolated linear trend fitted over the five-year pre–sudden-stop window.. Current account is expressed as a share of GDP and the real exchange rate (RER), calculated as an index, is expressed in levels. The data used is collected from IFS, WDI and the Total Economy Database.

Figure A.5: TFP in Spain

(a) Alternative Sources



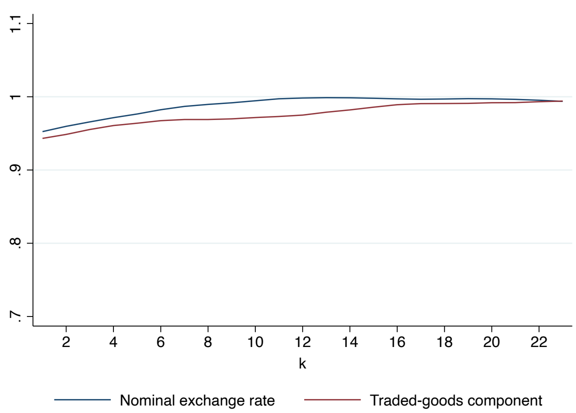
(b) Total Economy vs Manufacturing



Notes: Panel (a) plots the evolution of aggregate TFP in Spain using alternative data sources. The solid line shows the observed series, while the dashed line corresponds to a quadratic trend extrapolated from pre-2009 data. Sources include AMECO, Conference Board, EU KLEMS, OECD, and Penn World Tables. Panel (b) compares the TFP index for the total economy (blue) and the manufacturing sector (red). Sources are AMECO and EU KLEMS.

Figure A.6: Real Exchange Rate Decomposition

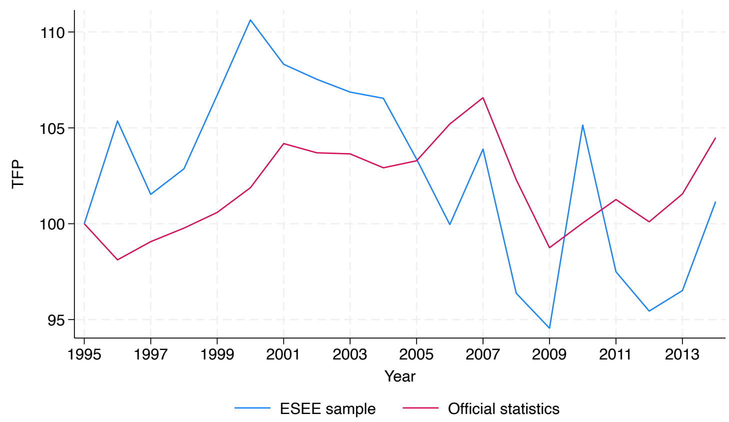
(a) 1992–1993 Sudden Stop



(b) 2010–2013 Sudden Stop

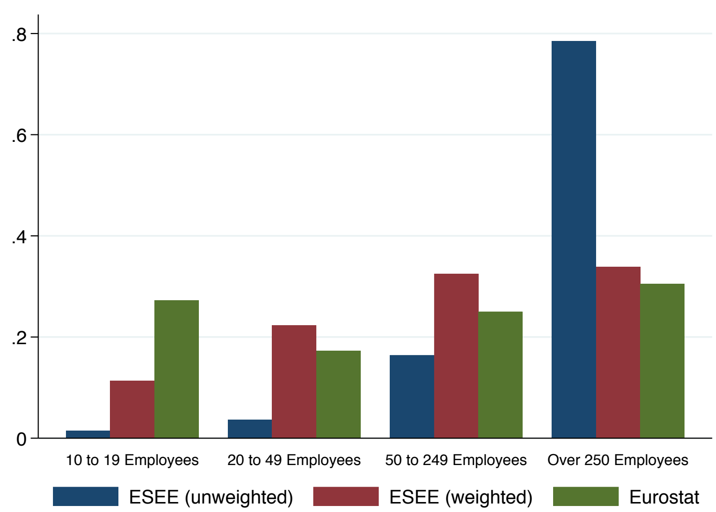
Notes: This figure applies the decomposition of Engel (1999) to the real exchange rate between Spain and Germany during two sudden stops. The real exchange rate is defined as $q_t = e_t + p_t^* - p_t$, where e_t is the log nominal exchange rate, p_t is the domestic price index, and p_t^* is the foreign price index. The figure plots the fraction of the mean squared error of $q_{t+k} - q_t$ attributed to the nominal exchange rate (blue) and to the traded-goods price component $x_t = e_t + p_t^{T*} - p_t^T$ (red). The non-traded component is inferred as a residual using CPI and PPI data. Monthly data are from the Bank of Spain and IMF International Financial Statistics.

Figure A.7: Manufacturing TFP in Spain - ESEE vs Official Statistics



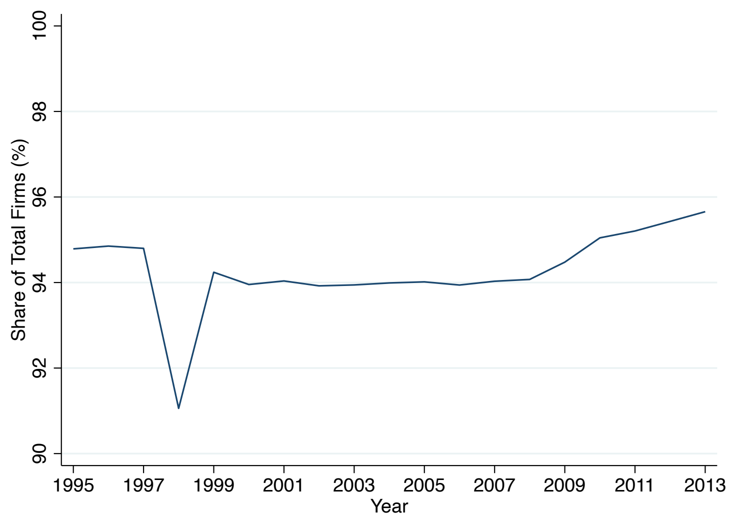
Notes: This figure plots the evolution of the TFP index in the ESEE sample (in blue) and the manufacturing sector according to official statistics (in red). The sources of the data are ESEE and EU Klems respectively.

Figure A.8: Share of Total Employment by Size Class



Notes: This figure plots the fraction of total employment accounted for by firms belonging to each size class. The blue and red bars report statistics from the ESEE dataset (unweighted and weighted correspondingly) and the green bar from Eurostat.

FIGURE A.9: EVOLUTION OF MICRO FIRMS IN SPAIN



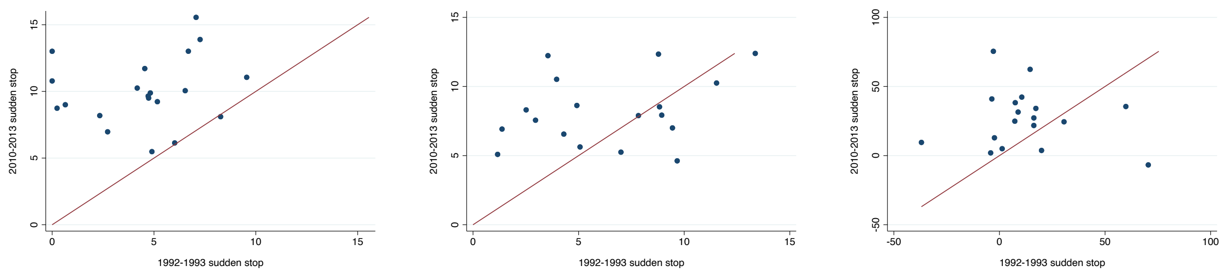
Notes: This figure plots the evolution of micro firms as a share of the total number of firms in the Spanish economy. Micro firms are defined as having less than ten employees. The data used is collected from the Spanish Business Registry (Directorio Central de Empresas, DIRCE).

FIGURE A.10: MISALLOCATION

Notes: This figure plots within-industry dispersion of the marginal revenue products of capital (MRPK) and labor (MRPL) over time. Firm-level marginal revenue products are constructed following Hsieh and Klenow (2009), assuming a capital share of 0.35 and a constant markup of 1.5. Sector-level standard deviations (in logs) are aggregated using time-invariant employment weights based on average employment shares over 2000–2012. All series are normalized to one in 2000. Data source: ESEE.

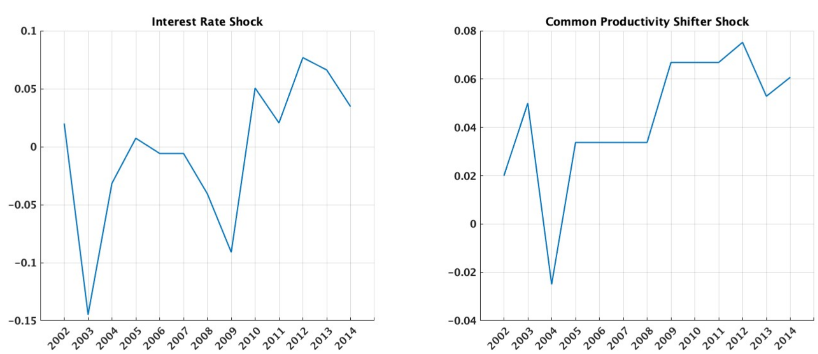
Figure A.11: Exit Features by Sector

(A) Exit Rate (B) Exiters' Size (C) Exiters' Productivity Gap



Notes: This figure plots the average exit rate, the average size of exiters, and the average productivity gap of exiters by industry for each sudden stop. The x-axis depicts the 1992–93 sudden stop while the y-axis depicts the 2010–13 sudden stop. Each dot represents a three-digit industry. Size is measured as the labor market share in the year prior to exit. The productivity gap is measured as the difference between incumbents' and exiters' average productivity in the year prior to exit. A 45-degree line is shown in red. Data source: ESEE.

Figure A.12: Evolution of Shocks



Notes. This figure plots the paths of the two aggregate shocks that I use to simulate the model. The left panel represents the interest rate shock, ϵ_t^R, and the right panel the common productivity shifter, ϵ_t^A.

E Additional Tables

TABLE A.1: LIST OF SUDDEN STOPS

Country	Start Year	End Year	Exchange Rate	Country	Start Year	End Year	Exchange Rate
Albania	1991	1992	4	Macedonia FYR	2009	2010	2
Argentina	1995	1995	2	Malaysia	1998	1998	4
Argentina	1999	2002	4	Mali	1991	1991	1
Argentina	2014	2014	3	Mexico	1995	1995	4
Belarus	2014	2015	3	Moldova	1998	2003	3
Brazil	2015	2015	4	Moldova	2012	2013	3
Bulgaria	1991	1991	4	Morocco	1996	1996	3
Bulgaria	2009	2010	2	New Zealand	2004	2010	4
Chile	1999	1999	3	Nicaragua	1991	1991	2
Chile	2009	2010	4	Oman	1999	2000	2
Colombia	1998	1999	3	Oman	2010	2010	2
Croatia	1997	2002	2	Peru	1991	1991	4
Croatia	2009	2010	2	Philippines	1998	1998	4
Cyprus	2011	2011	1	Poland	1990	1990	4
Czech Rep.	1997	2002	3	Portugal	2001	2003	1
Czech Rep.	2008	2008	3	Portugal	2009	2013	1
Czech Rep.	2011	2013	3	Romania	1999	1999	4
Ecuador	1999	2000	0	Russia	1998	2002	3
Estonia	1996	2001	2	Rwanda	1994	1994	4
Estonia	2008	2009	2	Saudi Arabia	1992	1992	2
Ethiopia	1991	1991	3	Saudi Arabia	1999	2000	2
Ethiopia	2003	2003	3	Senegal	1994	1994	1
Finland	1991	1993	3	Sierra Leone	1996	1996	4
Finland	2013	2013	1	Slovak Republic	1997	2002	3
France	1991	1993	2	South Africa	2008	2008	4
Gabon	1999	1999	1	Spain	1993	1993	3
Greece	1993	1993	2	Spain	2009	2010	1
Greece	2009	2013	1	Spain	2012	2013	1
Haiti	2003	2003	4	Sri Lanka	2001	2001	3
Haiti	2009	2010	3	Sudan	2010	2010	3
Indonesia	1998	1998	4	Sweden	1991	1991	3
Iran	1992	1992	4	Sweden	2009	2010	3
Iran	1994	1995	4	Thailand	1997	1998	4
Ireland	2009	2014	1	Turkey	1994	1994	4
Israel	2001	2001	3	Turkey	2001	2001	4
Italy	1993	1994	3	Ukraine	1998	2003	2
Italy	2007	2007	1	Ukraine	2014	2015	4
Italy	2011	2014	1	United Kingdom	1990	1991	3
Kenya	1991	1992	4	United States	2007	2007	4
Korea	1997	1998	4	Uruguay	2001	2001	3
Latvia	2008	2009	3	Venezuela	1994	1994	4
Lithuania	1997	2002	2	Venezuela	1999	2000	3
Macedonia FYR	2000	2006	2	Yemen Rep. of	2009	2014	3

Notes: This table reports the list of sudden stops as identified by the algorithm described in Online Appendix A.2. Exchange rate is a categorical variable that refers to the exchange rate regime in place at the end of the sudden stop: currency union (=1), hard peg (=2), soft peg (=3) and floating arrangement (=4). More details on the exchange rate classification are available in section 2. The data used is collected from the IMF's World Economic Outlook database and Ilzetzki, Reinhart and Rogoff (2019).

TABLE A.2: TFP during a Sudden Stop – Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$t = 0$	0.023	0.023	-0.745	0.023	-2.359	-0.944	-0.532	-1.405
	(0.418)	(0.434)	(0.368)	(0.444)	(1.266)	(1.235)	(0.976)	(1.125)
$t = 1$	0.739	0.739	-0.841	0.739	-1.935	0.185	0.364	-0.077
	(0.897)	(0.932)	(0.633)	(0.955)	(1.311)	(2.339)	(1.811)	(2.047)
$t = 2$	0.806	0.806	-1.617	0.806	-1.641	1.618	1.667	0.840
	(1.655)	(1.719)	(1.255)	(1.761)	(1.962)	(2.940)	(2.277)	(2.625)
$t = 0 \times float$	-4.474***	-2.625***	-2.978**	-1.103	-3.496*	-4.402*	-4.814**	-3.941*
	(0.828)	(0.578)	(0.854)	(0.590)	(1.601)	(1.639)	(1.448)	(1.555)
$t = 1 \times float$	-7.256***	-4.931***	-4.734***	-4.445***	-4.937*	-7.067*	-7.246**	-6.805**
	(1.402)	(1.120)	(1.164)	(0.958)	(1.864)	(2.681)	(2.230)	(2.428)
$t = 2 \times float$	-7.298**	-4.730*	-2.929	-3.535	-3.795	-6.689	-6.737*	-5.911
	(2.304)	(1.899)	(1.542)	(2.517)	(2.460)	(3.335)	(2.762)	(3.058)
N	127	67	96	52	87	103	119	111
R^2	0.375	0.309	0.273	0.148	0.428	0.225	0.223	0.217

Notes: This table reports robustness checks for the event-study estimates of total factor productivity (TFP) around sudden stops. Each column corresponds to a different specification or subsample, as described in Online Appendix A.3. Regressions include event-time indicators and their interaction with a floating exchange rate dummy, as well as sudden-stop episode fixed effects. Event time is normalized so that $t = 0$ denotes the start of the sudden stop. TFP is expressed as percentage deviations from an extrapolated linear trend fitted over the five-year pre–sudden-stop window. Standard errors, clustered at the episode level, are reported in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

TABLE A.3: Composition of Manufacturing Over Time

Industry	Output		Wage Bill	
	1993	2007	1993	2007
Chemical industry	0.12	0.12	0.12	0.10
Electrical and optical equipment	0.08	0.08	0.10	0.08
Food, beverages and tobacco	0.30	0.23	0.18	0.16
Machinery and equipment	0.06	0.08	0.08	0.10
Metallurgy and metal products	0.13	0.20	0.16	0.21
Non-metallic mineral products	0.07	0.09	0.08	0.10
Paper, publishing and printing	0.08	0.08	0.09	0.10
Rubber and plastics	0.04	0.05	0.06	0.06
Textile, clothing and leather	0.09	0.05	0.10	0.06
Wood and cork industry	0.03	0.03	0.03	0.03

Notes: This table reports the share of output and wage bill across two-digit manufacturing sectors. The source of the data is the Industrial Companies Survey by activity sector, published by the Spanish National Institute of Statistics (INE)

TABLE A.4: ESEE COVERAGE OF THE MANUFACTURING SECTOR

Panel (a): Relative to 2007 EU Klems Release

Year	Employment	Wage Bill	Value Added
1990	0.08	0.10	0.09
1991	0.10	0.13	0.11
1992	0.11	0.15	0.13
1993	0.11	0.15	0.13
1994	0.12	0.16	0.15
1995	0.12	0.15	0.15

Panel (b): Relative to 2016 EU Klems Release

Year	Employment	Wage Bill	Value Added
1995	0.12	0.16	0.16
1996	0.11	0.14	0.15
1997	0.12	0.16	0.17
1998	0.12	0.17	0.17
1999	0.12	0.16	0.16
2000	0.16	0.24	0.25
2001	0.15	0.23	0.23
2002	0.14	0.21	0.20
2003	0.12	0.17	0.17
2004	0.12	0.17	0.18
2005	0.15	0.21	0.21
2006	0.15	0.20	0.20
2007	0.16	0.20	0.21
2008	0.15	0.20	0.19
2009	0.15	0.20	0.18
2010	0.15	0.19	0.20
2011	0.15	0.19	0.17
2012	0.15	0.19	0.17
2013	0.15	0.18	0.16
2014	0.14	0.17	0.15

Notes: This table shows the coverage by year in employment, wage bill, and value added of the ESEE dataset relative to the aggregate data for Total Manufacturing reported by EU Klems. Panel (a) refers to the 2007 release, while Panel (b) focuses on the 2016 release.

TABLE A.5: EXTENSIVE MARGIN VALIDATION OF ESEE DATA

Panel (a): Over Time

Year	Entry Rate		Exit Rate	
	DIRCE	ESEE	DIRCE	ESEE
1998	0.037	0.025	0.026	0.033
1999	0.030	0.031	0.027	0.029
2000	0.027	0.022	0.027	0.029
2001	0.023	0.024	0.023	0.026
2002	0.021	0.020	0.022	0.105
2003	0.019	0.021	0.020	0.003
2004	0.019	0.020	0.021	0.032
2005	0.015	0.036	0.019	0.031
2006	0.015	0.021	0.016	0.023
2007	0.014	0.004	0.017	0.020
2008	0.010	0.008	0.018	0.020
2009	0.009	0.011	0.025	0.026
2010	0.010	0.023	0.017	0.032
2011	0.010	0.004	0.018	0.033
2012	0.012	0.016	0.020	0.030
2013	0.014	0.020	0.020	0.029

Panel (b): By Sectors (Year 2007)

Industry	DIRCE	ESEE	DIRCE	ESEE
Meat Products	0.010	0.020	0.012	0.011
Beverage	0.007	0.010	0.012	0.008
Textiles & Clothing	0.019	0.036	0.047	0.050
Leather, Fur & Footwear	0.037	0.051	0.062	0.080
Timber	0.011	0.017	0.015	0.028
Paper	0.007	0.003	0.007	0.006
Printing	0.013	0.025	0.013	0.010
Chemicals & Pharmaceuticals	0.011	0.021	0.008	0.016
Plastic & Rubber Products	0.011	0.014	0.015	0.034
Nonmetal Mineral Products	0.009	0.011	0.013	0.017
Basic Metal Products	0.016	0.024	0.011	0.016
Fabricated Metal Products	0.018	0.016	0.009	0.012
Machinery & Equipment	0.008	0.004	0.015	0.022
Computer Products, Electronics & Optical	0.003	0.006	0.013	0.017
Electric Materials	0.011	0.013	0.015	0.033
Vehicles	0.019	0.012	0.015	0.020
Other Transport Equipment	0.032	0.006	0.023	0.033
Furniture	0.011	0.010	0.016	0.024
Other Manufacturing	0.018	0.010	0.015	0.019

Notes: This table reports entry and exit rates of manufacturing firms with 10 or more employees, as measured by the Spanish Business Registry (Directorio Central de Empresas, DIRCE) and the ESEE dataset. Panel (a) reports rates over time across all sectors; Panel (b) reports sector-level rates for 2007.

Table A.6: Firm Characteristics Pre-Sudden Stop

	$Mean_{SS1}$	$Mean_{SS2}$	T-statistic
Firm Characteristics			
Age	16.96	26.91	-11.71***
Employment	49.14	51.61	-0.81
Sales	455.64	488.26	-0.68
Productivity Growth	-0.07	-0.11	1.57
Capital Intensity	0.89	0.89	-0.82
Leverage	0.15	0.15	0.09
Import Status	0.22	0.34	-5.92***
Export Status	0.25	0.39	-6.59***
Share by Industry			
Meat Products	0.02	0.04	-2.79***
Food & Tobacco	0.09	0.13	-2.62***
Beverage	0.01	0.03	-2.06**
Textiles & Clothing	0.12	0.07	4.18***
Leather, Fur & Footwear	0.05	0.03	1.97**
Timber	0.04	0.04	-0.48
Paper	0.02	0.02	0.40
Printing	0.07	0.05	1.30
Chemicals & Pharmaceuticals	0.05	0.05	-0.28
Plastic & Rubber Products	0.06	0.05	0.70
Nonmetal Mineral Products	0.06	0.07	-1.26
Basic Metal Products	0.01	0.03	-2.67***
Fabricated Metal Products	0.20	0.17	1.28
Machinery & Equipment	0.07	0.08	-0.64
Computer Products, Electronics & Optical	0.01	0.01	-1.69*
Electric Materials	0.03	0.02	2.01**
Vehicles	0.01	0.03	-3.01***
Other Transport Equipment	0.01	0.01	-1.58
Furniture	0.06	0.05	0.65
Other Manufacturing	0.02	0.02	1.04

Notes: This table characterizes firms exposed to each sudden stop, i.e., firms in years 1991 and 2009. *Sales* is normalized by GDP per capita. Productivity Growth corresponds to the percentage change of firm TFP between $t-1$ and t. Capital Intensity is measured as the capital to output ratio. Leverage is measured as the bank debt-to-assets ratio. *Import Status* is a dummy equal to one if the firm reports imports above 50,000€ in value. *Export Status* is a dummy equal to one if the firm reports exports above 50,000€ in value. The sum of shares by industry is equal to one for each column. The t-statistic corresponds to a two-tailed t test ; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

TABLE A.7: MOMENTS OF THE PRODUCTIVITY DISTRIBUTION

	1992-93 Episode		2010-13 Episode	
	Pre-sudden Stop	Sudden Stop	Pre-sudden Stop	Sudden Stop
Mean	0.31	0.17	0.12	0.13
Median	0.34	0.20	0.13	0.14
St. Dev.	0.61	0.64	0.71	0.66
Skewness	-0.40	-1.04	-2.21	-0.65
Kurtosis	6.12	9.14	24.98	6.40
Min	-3.37	-5.13	-9.00	-3.74
Max	2.73	2.76	2.75	3.58

Notes: This table summarizes moments of the distribution of firm-level TFP (in logs) before and after a sudden stop. The first two columns refer to the 1992-93 episode, while the last two focus on the 2010-13 episode. Pre-sudden stop measures are calculated using data from the year before the sudden stop starts. Sudden stop measures are calculated using data from the last year of the sudden stop. The data used is collected from the ESEE dataset.

TABLE A.8: DECOMPOSITION OF PRODUCTIVITY GROWTH - MATCHED DURATIONS

	Sudden Stops	
	1992–1993	2010–2011
Productivity Growth (%)	-12.96	3.23
Contribution to Productivity Growth		
Incumbents' Contribution	**-13.37**	**0.09**
Within-firm Contribution	-13.89	-2.67
Between-firm Contribution	-1.83	1.33
Cross-term Contribution	2.34	1.43
Net Entry Contribution	**0.41**	**3.14**
Entrants' Contribution	-1.81	-1.18
Exiters' Contribution	2.23	4.32

Notes: Productivity growth corresponds to the cumulative change in aggregate TFP over the stated periods. The decomposition follows the standard breakdown into incumbents (within-firm, between-firm, and cross-term components) and net entry (entrants and exiters). Contributions sum to total productivity growth. Details of the formal decomposition can be found in the main text. Source: ESEE.

TABLE A.9: ALTERNATIVE DECOMPOSITIONS OF PRODUCTIVITY GROWTH

	Baseline		FHK (2001)		MP (2015)	
	1992-1993	2010-2013	1992-1993	2010-2013	1992-1993	2010-2013
Productivity Growth (%)	-12.96	2.24	-12.96	2.24	-12.96	2.24
Contribution to Productivity Growth						
Incumbents' Contribution	**-13.37**	**-4.54**	**-12.01**	**-3.75**	**-12.46**	**-4.01**
Within-firm Contribution	-13.89	-7.36	-13.29	-6.30		
Between-firm Contribution	-1.83	0.32	-1.78	0.66		
Cross-term Contribution	2.34	2.50	3.05	1.89		
Shift Contribution					-14.04	-8.96
Reallocation Contribution					0.66	4.41
Net Entry Contribution	**0.41**	**6.79**	**-0.95**	**5.99**	**-0.50**	**6.26**
Entrants' Contribution	-1.81	-0.40	-3.09	-0.16	-2.66	-0.24
Exiters' Contribution	2.23	7.19	2.13	6.15	2.16	6.50

Notes: Productivity growth refers to accumulated TFP growth for the stated period. Base and final years are 1991 and 1993 for the first episode; 2009 and 2013 for the second episode. Columns (2) and (3) correspond to the baseline decomposition as explained in the main text. Columns (4) and (5) correspond to the Foster, Haltiwanger and Krizan (2001) decomposition as given by:

$$\Delta Z_t = \sum_{i \in C} s_{i,t-1} \Delta Z_{i,t} + \sum_{i \in C} \Delta s_{i,t} \left(Z_{i,t-1} - Z_{t-1}\right) + \sum_{i \in C} \Delta s_{i,t} \Delta Z_{i,t} + \sum_{i \in N} s_{i,t} \left(Z_{i,t} - Z_{t-1}\right) - \sum_{i \in X} s_{i,t-1} \left(Z_{i,t-1} - Z_{t-1}\right),$$

where $s_{i,t}$ is the employment share and Z_{t-1} is the aggregate productivity level in period *t-1*. Columns (6) and (7) correspond to the Melitz and Polanec (2015) decomposition as given by:

$$\Delta Z_t = \Delta \bar{Z}_t^C + \Delta \operatorname{Cov}(s_{i,t}^C, Z_{i,t}^C) + s_t^N \left(Z_t^N - Z_t^C\right) - s_{t-1}^X \left(Z_{t-1}^X - Z_{t-1}^C\right),$$

where $\bar{Z}_t^C$ is the unweighted mean change in the productivity of incumbents and $\operatorname{Cov}(s_{i,t}^C, Z_{i,t}^C)$ is the covariance change between employment share and productivity for incumbents. The data used is collected from the ESEE dataset.

TABLE A.10: DECOMPOSITION OF PRODUCTIVITY GROWTH USING ALTERNATIVE WEIGHTS

	Baseline		Value-added		Sales	
	1992–1993	2010–2013	1992–1993	2010–2013	1992–1993	2010–2013
Productivity Growth (%)	-12.96	2.24	-11.72	3.94	-10.80	3.51
Contribution to Productivity Growth						
Incumbents' Contribution	**-13.37**	**-4.54**	**-12.41**	**-1.39**	**-11.85**	**-1.77**
Within-firm Contribution	-13.89	-7.36	-17.92	-14.78	-16.99	-13.16
Between-firm Contribution	-1.83	0.32	-6.09	-2.98	-4.49	-2.32
Cross-term Contribution	2.34	2.50	11.58	16.37	9.62	13.72
Net Entry Contribution	**0.41**	**6.79**	**0.70**	**5.34**	**1.05**	**5.28**
Entrants' Contribution	-1.81	-0.40	-1.25	-1.18	-1.07	-1.25
Exiters' Contribution	2.23	7.19	1.95	6.52	2.12	6.54

Notes: Productivity growth refers to accumulated TFP growth for the stated period. Base and final years are 1991 and 1993 for the first episode; 2009 and 2013 for the second episode. Columns (2) and (3) correspond to the baseline decomposition as explained in the main text. Columns (4) and (5) use value-added weights while columns (6) and (7) use sales weights.

TABLE A.11: FIRM EXIT, PRODUCTIVITY, AND MARKUPS

	(1)	(2)	(3)
TFP_{it}	-0.038***		-0.037***
	(0.005)		(0.005)
$ss^1_{t+1} \times TFP_{it}$	0.007		0.006
	0.013)		(0.013)
$ss^2_{t+1} \times TFP_{it}$	-0.052***		-0.051***
	(0.011)		(0.012)
$markup_{it}$		-0.009***	-0.003
		(0.003)	(0.003)
$ss^1_{t+1} \times markup_{it}$		0.004	0.003
		(0.009)	(0.009)
$ss^2_{t+1} \times markup_{it}$		-0.017***	-0.001
		(0.006)	(0.006)
Observations	36,252	36,252	36,252
Industry-Year FE	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes

Notes: All regressions are linear probability models where exit=1 if a firm that operates in period t exits the market in period $t+1$. TFP_{it} is log firm-level total factor productivity, and $markup_{it}$ is the firm's log estimated markup, constructed using the production approach of De Loecker and Warzynski (2012). ss^1_{t+1} equals one for years 1992–1993 and ss^2_{t+1} for 2010–2013. All regressions include industry-year fixed effects and firm size class controls. Standard errors (in parentheses) are based on bootstrapping. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

TABLE A.12: DECOMPOSITION OF PRODUCTIVITY GROWTH USING ORBIS

	Czech Republic 2011-2013	Spain 2010-2013
Productivity Growth (%)	-7.18	8.83
Contribution to Productivity Growth		
Incumbents' Contribution	**1.20**	**2.20**
Within-firm Contribution	-2.72	-1.28
Between-firm Contribution	3.27	1.89
Cross-term Contribution	0.65	1.59
Net Entry Contribution	**-8.38**	**6.63**
Entrants' Contribution	-6.14	-0.19
Exiters' Contribution	-2.24	6.82

Notes: Productivity growth refers to accumulated TFP growth for the stated period. Base and final years are 2010 and 2013 for the Czech Republic sudden stop and 2009 and 2013 for the Spanish sudden stop. Contribution of incumbents and net entrants add up to productivity growth. Contribution of within-firm, between-firm and cross-term components add up to incumbents' contribution. Contribution of entrants and exiters add up to net entry contribution. Details of the formal decomposition can be found in Online Appendix B.4. The data used is collected from ORBIS.

TABLE A.13: REALLOCATION AND PRODUCTIVITY USING ORBIS

	Spain			Czech Republic		
	Exit	Labor Growth (Incumbents & Exiters)	Labor Growth (Incumbents Only)	Exit	Labor Growth (Incumbents & Exiters)	Labor Growth (Incumbents Only)
	(1)	(2)	(3)	(4)	(5)	(6)
TFP_{it}	-0.049**	0.033***	0.026***	-0.003***	0.047***	0.047***
	(0.017)	(0.005)	(0.007)	(0.001)	(0.008)	(0.008)
$ss_{t+1} \times TFP_{it}$	-0.060***	-0.005	0.001	0.004***	0.032***	0.032***
	(0.021)	(0.007)	(0.010)	(0.001)	(0.007)	(0.007)
Observations	43,286	26,435	17,204	77,967	60,340	60,118
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regression for exit is a linear probability model where exit=1 if a firm that operates in period t exits the market in period $t+1$. Labor growth is measured from period t to period $t+1$. TFP_{it} is the log firm-level TFP at time t and ss_{t+1} is a dummy equal to one for years 2011-2013 in regressions (1)-(3) and years 2010-2013 in regressions (4)-(6). Firm controls in period t account for age and size effects. Standard errors (in parentheses) are clustered using bootstrapping methods; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

TABLE A.14: FIRM EXIT AND PRODUCTIVITY WITH ADDITIONAL CONTROLS USING ORBIS

	Spain		Czech Republic	
	(1)	(2)	(3)	(4)
TFP_{it}	-0.049**	-0.044*	-0.003***	-0.003***
	(0.017)	(0.020)	(0.001)	(0.001)
$ss_{t+1} * TFP_{it}$	-0.060***	-0.082***	0.004***	0.003***
	(0.021)	(0.024)	(0.001)	(0.001)
$leverage_{it}$		0.017***		0.002***
		(0.004)		(0.001)
$ss_{t+1} * leverage_{it}$		0.000		-0.002**
		(0.008)		(0.001)
Observations	43,286	25,751	$77,967$	77,967
Industry-Year FE	Yes	Yes	Yes	Yes
Firm Controls FE	Yes	Yes	Yes	Yes

Notes: All regressions are linear probability models where exit=1 if a firm that operates in period t exits the market in period $t+1$. TFP_{it} is the log firm-level TFP at time t and and ss_{t+1} is a dummy equal to one for years 2011-2013 in regressions (1)-(2) and years 2010-2013 in regressions (3)-(4).$leverage_{it}$ is captured by the debt-to-assets ratio. Firm controls in period t account for age and size effects. Standard errors (in parentheses) are clustered using bootstrapping methods; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

References

Calvo, Guillermo A., Alejandro Izquierdo, and Luis-Fernando Mejía. 2004. "On the Empirics of Sudden Stops: the Relevance of Balance-Sheet Effects." NBER Working Paper 10520.

Cavallo, Eduardo A, and Jeffrey A Frankel. 2008. "Does Openness to Trade Make Countries More Vulnerable to Sudden Stops, or Less? Using Gravity to Establish Causality." *Journal of International Money and Finance*, 27(8): 1430–1452.

Dias, Daniel A., and Carlos Robalo Marques. 2021. "Every Cloud Has a Silver Lining: Micro-Level Evidence on the Cleansing Effects of the Portuguese Financial Crisis." *Oxford Bulletin of Economics and Statistics*, 83(2): 352–376.

Foster, Lucia, John C Haltiwanger, and Cornell John Krizan. 2001. "Aggregate Productivity Growth: Lessons from Microeconomic Evidence." In *New Developments in Productivity Analysis*. 303–372. University of Chicago Press.

Hsieh, Chang-Tai, and Peter J. Klenow. 2009. "Misallocation and Manufacturing TFP in China and India." *The Quarterly Journal of Economics*, 124(4): 1403–1448.

Hsieh, Chang-Tai, and Peter J. Klenow. 2017. "The Reallocation Myth." Available at: `https://www.kansascityfed.org/~/media/files/publicat/sympos/2017/hsieh-klenow-paper.pdf`.

Ilzetzki, Ethan, Carmen M. Reinhart, and Kenneth S. Rogoff. 2019. "Exchange Arrangements Entering the 21st Century: Which Anchor Will Hold?" *The Quarterly Journal of Economics*, 134(2): 599–646.

Klein, Michael W., and Jay C. Shambaugh. 2008. "The Dynamics of Exchange Rate Regimes: Fixes, Floats, and Flips." *Journal of International Economics*, 75(1): 70–92.

Melitz, Marc J., and Sašo Polanec. 2015. "Dynamic Olley-Pakes Productivity Decomposition with Entry and Exit." *The Rand Journal of Economics*, 46(2): 362–375.

Olley, G Steven, and Ariel Pakes. 1996. "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica*, 64(6): 1263–1297.