Appendix (for Online Publication) to

Sudden Stops, Productivity, and the Exchange Rate

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A Firm-level Data

A.1 Comparability of Episodes

This appendix provides more detailed evidence that the 1992-92 and the 2010-13 sudden stops in Spain were similar in a number of dimensions, which allow for their comparison, but crucially differ in the response of exchange rate policy.

The inflow of capital into the Spanish economy was particularly pronounced during the late 1980s and for much of the 2000s, to a great extent driven by important headways in the European integration agenda. The accession to the European Union club in 1986 and the launch of the common currency in 2002 explain the behavior of the sovereign debt risk premium in the years preceding the sudden stops as depicted in the first plot of Figure A.2. Given the flow of foreign money, these were years of growing current account deficits, which peaked at 3.5% in 1991 and 9.6 % in 2007 respectively. At the same time, Spain was forfeiting its international competitive edge, with its real exchange rate appreciating 28% between 1986-1991 and 16% between 2001-2007.

Both pre-crisis periods were also characterized by a booming construction sector, as summarized by its growing contribution to GDP. While a level comparison is unfortunately uninformative given changes in the methodology used by the National Statistics Office over time, the last plot of Figure A.2 shows that the share of construction value added had been increasing since 1986 when the first sudden stop hit and had shortly reversed from a nine year upward trend when the second unfolded. Similarly, housing prices grew an average of 3.8% and 3.5% per year in the six years preceding the two sudden stops and fell on average by 6.6% and 8.1% per year during the crises as measured by Mack and Martínez-García (2011)'s Real Housing Price Index. Moreover, Martínez-Toledano (2020) argues that Spain experienced two house price cycles over the last three decades and identifies the turning points to be 1991 and 2007, slightly before (or just as) capital inflows started to reverse.

The increase in housing demand and the ease of credit came along with indebtedness for households and non-profit corporations. The escalation of debt held by the private sector, however, was substantially larger in the early to mid 2000s. The IMF estimates that private debt which amounted to almost 80% of GDP in 1991, was roughly 40% higher by 2009. Not surprisingly, the later sudden stop overlapped with a banking crisis, an important caveat that I partially address when considering alternative explanations. The public sector, however, was in a similar good shape, with sovereign debt as low as 42% in 1991 and 39% in 2008.[1]

The onset of each sudden stop shares a common thread: a backlash to European integration. Following the external political turmoil, Spain faced an exodus of foreign investment that narrowed the current account deficit and forced a real depreciation that improved international com-

[1]By 2009 the government had already increased the amount it owed to 53% as a response to the Great Financial Crisis, which unfolded worldwide just before Spain experienced its second sudden stop.

petitiveness. The second and third plots of A.2 show that, despite the differences in magnitude discussed in the main text, the current account follows a similar trend after 1992 and 2010. In addition, the annual decline in the real exchange rate index was close to 4% on average during both sudden stops.

The real effects of the sudden stop translated into negative growth rates and rising unemployment. Real output grew an average of -0.2% and -1.4% during the crises, while unemployment reached its maximum rate at 24.1% in 1994 and 26.1% in 2013. The public deficit skyrocketed due to automatic stabilizers and despite directed efforts to restrain public spending. In the earlier episode, unemployment benefits were slashed both in 1992 and 1993. In the later episode, public wages were cut back in 2010 and 2011 and a controversial array of austerity measures was announced in the summer of 2012. Note that while the latter was wider, affecting even health and education, and larger, amounting to 65 000 million of Euros in two years; it was also implemented at a later stage of the sudden stop. Structural reforms were also implemented in the form of three labor market reforms: in 1994, 2010 and 2012. All three shared, to a certain extent, the aim to enhance collective bargaining, reduce employment protection and encourage internal flexibility.

A key difference across episodes is the exchange rate regime that was in place as the external adjustment occurred. In the first sudden stop, the three consecutive devaluations of the peseta depreciated the nominal effective exchange rate by more than the real effective exchange rate (14.0% vs 8.3%). In the second sudden stop, the common currency prevented the nominal effective exchange rate from fluctuating much (2.6%), especially when compared to the size of the real depreciation (14.7%).

A.2 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 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). Second, the ESEE provides its own industry classification based on the sum of the three-digit 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.[2] My approach is to use sector contribution to total manufacturing value added in 2018, also provided by the NSI, as the relevant weight.[3]

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.[4,5]

A.3 Discrepancies with other Firm-level Analysis

This appendix reviews two other papers that measure TFP in Spain using alternative micro-sources, highlights how their results compare to those here presented and discusses what might be driving any discrepancies.

On the one hand, Gopinath et al. (2017) study the pre-crisis slowdown of productivity in Spain and argue that it is driven by increasing capital misallocation. While the authors exploit micro-data from ORBIS to estimate two-digit industry revenue functions and measure marginal revenue products of capital and labor at the firm level, their observed aggregate TFP measure is computed as a Solow residual at the industry level. Together with differences in the cleaning procedure (the standard approach involves dropping some firm-year observations, generating artificial entry and exit dynamics, which this paper purposely avoids) and a coverage that extends no longer than 2012, this partly explains why Figure V only captures a flat performance of TFP since 2010.

Fu and Moral-Benito (2018), on the other hand, document an increase in TFP since 2010 using firm-level from the Bank of Spain, which is consistent with my results. They argue, however, that the extensive margin is not a major contributor of this trend. There are two important differences in sample selection: their focus is on non-financial firms (versus the manufacturing sector) and their decomposition exercise uses 2010 as the base year and 2015 as the final year (as opposed to 2009 and 2013). More importantly, their dataset is based on the Central Balance Sheet Data (Central de Balances Integrada, CBI, in Spanish), which uses the same source of data that constitutes

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

[3] 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.

[4] 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.

[5] 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 Spanish input for ORBIS: annual financial statements that firms are obliged to submit to the Commercial Registry. It is therefore subject to the same limitations, in particular, how accurately it captures firm exit.

A.4 Production Function Estimation

This appendix reviews the Ackerberg, Caves and Frazer (2015) correction to the proxy approach to production function estimation. I augment it to account for attrition as first proposed by Olley and Pakes (1996).

Consider the model,

$$y_{it} = \alpha + \beta_s^k k_{it} + \beta_s^l l_{it} + \omega_{it} + \epsilon_{it}\,, \tag{29}$$

where y_{it} is value added, k_{it} is capital and l_{it} is labor input. ω_{it} is unobserved firm-level TFP and modelled as a Markov chain, $\omega_{it} = g\left(\omega_{it-1}\right) + \xi_t$.

The standard practice is to estimate industry output elasticities for capital and labor by regressing value added on input choices and to compute firm-level productivity as the Solow residual. When performing the first step, two potential problems emerge. First, productivity is unobservable and strongly correlated with input choices. A simple OLS regression will therefore deliver biased estimates of the desired elasticities because of simultaneity. Second, there is a selection bias due to the fact that firm survival is related to the unobserved productivity level: firms that remain in the sample tend to be the most productive ones.

To overcome the former issue, I follow the proxy variable approach (see Olley and Pakes (1996) and Levinsohn and Petrin (2003)) among the possibilities offered by the literature.[6] Intuitively, this method substitutes unobserved productivity by a proxy variable in the original regression. A proxy variable is an observable input or choice variable for which the mapping with respect to productivity is assumed to be invertible. Coefficients of the inputs that do not enter this mapping, mainly labor, can be non-parametrically estimated using OLS in a first stage. The remaining coefficients, capital, are estimated next by exploiting the zero correlation assumption between the unexpected component of productivity and the input choice using GMM. I use materials deflated by the output price deflator as the proxy variable. To account for labor dynamics, however, I implement the refinement introduced by Ackerberg, Caves and Frazer (2015) that consists of identifying all coefficients in the second stage by using conditional (as opposed to unconditional) moments.[7]

[6] The other alternatives are fixed effects, instrumental variables, first order conditions and a dynamic panel approach.

[7] In addition to accounting for labor dynamics, Ackerberg, Caves and Frazer (2015) improves on the Wooldridge (2009)'s extension of the Levinsohn and Petrin (2003) approach by allowing for unobserved serially correlated shocks to wages. Their framework also overcomes Gandhi, Navarro and Rivers (2016)'s concern regarding the non-identification result of the proxy variable approach by assuming a Leontief production function in materials. As a robustness check, nevertheless, I show that these two alternative methodologies generate firm-level TFP series which are highly correlated with my baseline TFP.

To control for attrition, I include an intermediate stage in which the probability of survival is estimated by fitting a probit model on materials, labor and capital in the spirit of Olley and Pakes (1996). This probability is then included as a regressor in the final stage.

Formally, I assume:

1. There exists an observable input or choice variable $m_{it} = f_t(k_{it}, l_{it}, \omega_{it})$ such that f_t is strictly monotonic in ω_{it}.

2. ω_{it} is the only econometric unobservable in the mapping above.

The production function, equation (29), can be rewritten as:

$$y_{it} = \alpha + \beta_s^k k_{it} + \beta_s^l l_{it} + f_t^{-1}(k_{it}, l_{it}, m_{it}) + \epsilon_{it} \,,$$

where all regressors are now observable.

First stage As opposed to the standard proxy approach (Olley and Pakes (1996), Levinsohn and Petrin (2003)), allowing for labor dynamics with functional dependence prevents me from identifying the labor coefficient, β^l, in the first stage. Instead, I am only able to remove the shock ϵ_{it} from the dependent variable y_{it} by treating f_t^{-1} non-parametrically and recover $\hat{\Phi}_{it}$ from:

$$y_{it} = \Phi_{it}(k_{it}, l_{it}, m_{it}) + \epsilon_{it} \,.$$

Second stage A firm will continue to operate provided its productivity level exceeds the lower bound: $\chi_{it} = 1$ if $\omega_{it} \geq \underline{\omega}_{it}$, where χ_i is a survival indicator variable. I estimate the survival probability, $\hat{P}_{it}$, by fitting a probit model on capital, labor and the proxy variable:

$$P_{it} \equiv Pr\{\chi_t = 1 \,|\, \underline{\omega}_{it}, I_{t-1}\} = h_t(k_{it-1}, l_{it-1}, m_{it-1}) \,,$$

where I_{t-1} is the information set at time $t-1$.

Third stage Given guesses for β^k and β^l, it is possible to obtain the residuals

$$\hat{\omega}_{it} = \hat{\Phi}_{it} - \beta^k k_{it} - \beta^l l_{it} \,,$$

and, exploiting the Markov chain assumption on ω_{it}, obtain the corresponding residual $\hat{\xi}_{it}$ by simply regressing $\hat{\omega}_{it}$ on $\hat{\omega}_{it-1}$ and $\hat{P}_{it}$. β_k and β_l are estimated using the following GMM criterion function:

$$\frac{1}{N}\frac{1}{T}\sum_i \sum_t \begin{pmatrix} \hat{\xi}_{it} k_{it} \\ \hat{\xi}_{it} l_{it-1} \end{pmatrix} = 0 \,.$$

A.5 TFP Growth Decomposition

This appendix derives the TFP growth decomposition specification used in Table 1. 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,

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

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 $j = \{C, N, E\}$.

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 $s_{t-1}^E = s_t^X = 0$. By exploiting the fact that $s_{t-1}^C + s_{t-1}^X = 1$ and $s_t^C + s_t^N = 1$ and using the expression above, I can rewrite the change in aggregate productivity as

$$\Delta Z_t = Z_t^C - Z_{t-1}^C + s_t^N \left(Z_t^N - Z_t^C \right) - s_{t-1}^X \left(Z_{t-1}^X - Z_{t-1}^C \right) \,.$$

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_t^N, and exiters, s_{t-1}^X, 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 (2018) 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_t^C, the change in aggregate productivity can be further decomposed as:

[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:

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

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

The contribution by incumbents maps exactly into that in Foster, Grim and Haltiwanger (2016). 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.

A.6 Allocative Efficiency

This appendix summarizes the Hsieh and Klenow (2009) argument that resource misallocation can hinder aggregate productivity and explains how I measure marginal revenue products dispersion.

Consider a framework with a final good featuring a CES production function in differentiated intermediates goods that are imperfectly substitutable. Intermediate good producers have standard Cobb-Douglas production technologies, with capital share α, and are subject to firm-specific exogenous wedges that distort (i) output, τ_{it}^y, and (ii) capital relative to labor, τ_{it}^k. The individual intermediate good producer optimization problem delivers the following first-order conditions with respect to labor, l_{it}, and capital, k_{it}:

$$MRPL_{it} = \left(\frac{1-\alpha}{\mu}\right)\left(\frac{P_{it}Y_{it}}{L_{it}}\right) = \left(\frac{1}{1-\tau_{it}^y}\right)W_t\,, \tag{30}$$

$$MRPK_{it} = \left(\frac{\alpha}{\mu}\right)\left(\frac{P_{it}Y_{it}}{K_{it}}\right) = \left(\frac{1+\tau_{it}^k}{1-\tau_{it}^y}\right)R_t\,, \tag{31}$$

where $P_{it}Y_{it}$ is firm nominal value added, W_t is the cost of labor, R_t is the cost of capital and μ is the constant markup of price over marginal cost. I set the capital share to be equal to 0.35 and the constant markup equal to 1.5 as in Gopinath et al. (2017). I first obtain sector-level measures of dispersion in logs which I then aggregate into an economy-wide employment-weighted average using time-invariant weights corresponding to the 2000-2014 employment share average.

Hsieh and Klenow (2009) formally show that aggregate TFP in this economy is highest when resources are allocated optimally. This is achieved only if firms face equal distortions and marginal revenue products above are equalized. To see this, define physical and revenue productivities at the firm-level as

$$TFPQ_{it} \equiv A_{it} = \frac{Y_{it}}{K_{it}^{\alpha}L_{it}^{1-\alpha}}\,, \tag{32}$$

and

$$TFPR_{it} \equiv P_{it}A_{it} = \frac{P_{it}Y_{it}}{K_{it}^{\alpha}L_{it}^{1-\alpha}} . \tag{33}$$

By substituting equations (30) and (31) into equation (33),

$$TFPR_{it} = \mu \left(\frac{MRPK_{it}}{\alpha}\right)^{\alpha} \left(\frac{MRPL_{it}}{1-\alpha}\right)^{1-\alpha} = \mu \left(\frac{R_t}{\alpha}\right)^{\alpha} \left(\frac{W_t}{1-\alpha}\right)^{1-\alpha} \frac{\left(1+\tau_i^k\right)^{\alpha}}{1-\tau_i^y} ,$$

it follows that optimal allocation of labor and capital ensures that firms with higher TFPQ expand production such that they charge lower prices than more unproductive firms and TFPR is equalized across plants. In other words, dispersion in TFPR is solely driven by the presence of firm-specific distortions in this model. Such distortions can lower aggregate TFP by the following expression:

$$TFP_t = \left[\sum_{i=1} \left(A_{it}\frac{\overline{TFPR}_t}{TFPR_{it}}\right)^{\sigma-1}\right]^{\frac{1}{1-\sigma}} ,$$

where $\overline{TFPR}_t$ is the revenue weighted average TFPR. Periods of higher TFP should be associated with periods of lower marginal revenue product dispersion and differences in the results for capital and labor can be interpreted as evidence of the different types of wedges that prevail.

A.6.1 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 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 account for this possibility, this appendix performs two different exercises: first, it looks at the evolution of exit rates over each of the crisis; second, it decomposes the contribution of incumbents, entrants and exiters year by year. Figure A.3 plots the share of exiting firms by year. With the exception of the 2002-03 jump, the overall trend is relatively flat, with crisis periods just above the average. Particularly relevant for my analysis, the 2010-13 sudden stop is characterized by higher exit rates during the first three (and not the last) years of the crisis. This contradicts the argument that exit patterns are mostly driven by a longer duration.

Table A.3 summarizes the results of the annualized decomposition of TFP growth. This is computed by looking at year-on-year changes and taking averages for the crisis periods. Results show that, although magnitudes are reduced, the main conclusions hold: there is pro-cyclicality of productivity at the firm level in both sudden stops but only a sizable composition effect that overturns the aggregate trend in the later episode.

A.7 Robustness

A.7.1 Aggregating TFP Using Value-Added Weights

Table A.2 presents the results for the TFP growth decomposition exercise in the main text, but defining aggregate TFP as the value-added weighted average of firm-level TFP. The magnitudes of aggregate productivity changes are roughly the same for both sudden stops. 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.

As for the 2010-13 sudden stop, the relative role of the extensive margin is slightly dampened compared to the baseline results. While the contribution of net entrants is still positive and sizable, it now represents 40% of overall growth. This is, once again, fully explained by the exit of unproductive firms. The other main different is the lack of market reallocation, which is compensated by a large positive covariance between productivity and market share changes at the firm level. In sum, although with some minor differences, the main conclusions hold when considering value-added weights.

A.7.2 Accounting for Sampling Weights

Large firms are over-represented in the ESEE, and thus in my sample, for two reasons. First, the initial survey in 1990 included all firms operating in Spain with more than 200 workers but only a stratified, proportional and systematic sample with random seed of firms employing between 10 and 200 workers. Second, incorporation of new firms every year is also biased towards larger firms: all new entrants with more than 200 workers are included versus only a random selection representing 5% of those with 10 to 200 workers.

Accounting for sampling weights would be the standard way to proceed. However, these are not available on a year-to-year basis. As a second best I present the unweighted results as the baseline in the main text and conduct a robustness test with the sampling weights provided. These correspond to years 1990, 2005, 2009 and 2011. I assume sampling weights remain constant between vintages.

All main results are robust to accounting for sampling weights. Figure A.6 resembles strongly its main text counterpart, confirming that the change in log TFP is concentrated on the lowest percentiles of the firm productivity distribution during both sudden stops. The TFP decomposition exercise summarized by Table A.6 underscores the importance of the extensive margin in the 2010-13 episode - the contribution of net entry is larger than previously reported. In fact, as predicted under a negative correlation between firm's propensity to exit and firm size, the baseline result can be interpreted as a lower bound. The main difference, however, is that while the change in aggregate TFP is still positive in the most recent sudden stop, its magnitude is now much smaller. Tables A.7 and A.8 show that accounting for sampling weights barely changes the regressions results for the cleansing hypothesis test.

A.7.3 An Alternative Dataset - ORBIS

The global company database ORBIS, produced by Bureau van Dijk, has risen as the predominant source for firm-level analysis given the extent of companies covered. Particularly relevant to my analysis, it collects data from a large number of smaller firms (SMEs), which account for a greater share of economic activity in Spain and matches better the firm-size distribution of the universe of firms. While it is not as suited to study the role of the extensive margin given its poor monitoring of firm exit and data only goes back to the late 1990s, I redo part of the analysis using ORBIS. Note that the cleaning procedure follows that used for the ESEE dataset.

Tables A.9 and A.10 confirm the prevalence of a cleansing effect during the 2010-2013 sudden stop. According to the ORBIS data, TFP increases during this period almost 9%, which is very close to the baseline finding, 10%. The exit of unproductive firms explains three quarters of growth, while the reallocation of resources to more productive firms overcomes the negative firm-level productivity growth of incumbents. Similarly, the sudden stop is a period during which the negative correlation between propensity to exit and firm productivity strengthens. On the other hand, the interaction coefficient in the labor growth regression is only positive for the incumbent-only subsample. Even in this case, however, it is not statistically significant; this stands in contrast with the baseline results.

ORBIS does not provide any information on firms' engagement in foreign trade. This prevents me from testing all the alternative explanations that the main text considers. However, Table A.11 shows that controlling for the exposure to the construction sector and the financial health of the firm does not affect the magnitude nor the stability of the key productivity coefficients. In addition, Table A.12 confirms that firms' markups are increasing in firm-level productivity and declining in aggregate productivity. The latter holds for both TFP at the aggregate level as well as at the industry level.

B Details on the Baseline Model

B.1 Summary of Equilibrium Conditions

Endogenous variables: z_t^H, z_t^F, z_t^{*F}, L_t, N_t, B_t, R_t, P_t, λ_t, W_t, ϵ_t
Equilibrium conditions:

$$z_t^H = \frac{\gamma + \eta N_t}{\frac{\alpha\gamma}{\lambda_t} + \eta P_t} W_t^{\sigma}, \tag{34}$$

$$z_t^F = \frac{\gamma + \eta N_t}{\frac{\alpha\gamma}{\lambda_t} + \eta P_t} \tau \epsilon_t (W_t^*)^\sigma \,, \tag{35}$$

$$z_t^{F*} = \frac{B}{A} \frac{\tau W_t^\sigma}{\epsilon_t} \,, \tag{36}$$

$$N_t = M (z_t^H)^{-k} + M^* (z_t^F)^{-k} \,, \tag{37}$$

$$P_t = \frac{2k+1}{2k+2} \frac{W_t^\sigma N_t}{z_t^H} \,, \tag{38}$$

$$L_t = \frac{k}{(k+1)(k+2)} \sigma W_t^{2\sigma-1} M \left(\frac{\lambda_t}{\gamma} \left(z_t^H \right)^{-(k+2)} + \frac{B\tau^2}{\epsilon_t} \left(z_t^{F*} \right)^{-(k+2)} \right) \,, \tag{39}$$

$$1 = \beta R_t \mathbb{E}_t \left(\frac{\epsilon_{t+1}}{\epsilon_t} \frac{\lambda_{t+1}}{\lambda_t} \right) \,, \tag{40}$$

$$R_t = R_t^* + \phi \left(e^{\bar{B} - B_t} - 1 \right) + \left(e^{\xi_t - 1} - 1 \right) \,, \tag{41}$$

$$MB \frac{(\tau W_t^\sigma)^2}{\epsilon_t} \left(z_t^{F*} \right)^{-(k+2)} - M^* \frac{\lambda_t \left(\tau \epsilon_t (W_t^*)^\sigma \right)^2}{\gamma} \left(z_t^F \right)^{-(k+2)} = 2(k+2) \epsilon_t (B_t - R_{t-1} B_{t-1}) \,, \tag{42}$$

$$W_t = \prod_{s=0}^{\infty} \left(\frac{\theta}{\theta - 1} \mathbb{E}_{t-s} \left(\frac{1}{\lambda_t} \right) \right)^{\mu(1-\mu)^s} \,, \tag{43}$$

$$\text{monetary policy rule} \,. \tag{44}$$

B.2 A Model of Two Large Countries: The Limit Case

This appendix shows that the assumptions required to treat Home as a small open economy can be derived from the steady state version of a model with two countries which are symmetric in everything except size *i.e.* Home is assumed to be small relative to Foreign. In particular, if the two countries are endowed with n and $n-1$ shares of the world's total number of potentially active firms, $\bar{M}$,

$$M = n\bar{M}, \quad M^* = (1-n)\bar{M}, \quad n \in [0,1],$$

then the limit case to be considered is one in which $n \to 0$. The productivity cutoffs of this model would be given by the steady state versions of equations (34) and (35) together with:

$$z^{*F} = \frac{\gamma + \eta N}{\frac{\alpha\gamma}{\lambda} + \eta P} \tau \epsilon (W^*)^\sigma \,, \tag{45}$$

$$z^{*H} = \frac{\gamma + \eta N^*}{\frac{\alpha\gamma}{\lambda^*} + \eta P^*} (W^*)^\sigma \,, \tag{46}$$

The number of active firms in Home and Foreign is given by equation (37) and

$$N^* = (1-n)\bar{M}^*(z^{*H})^{-k} + n\bar{M}(z^F)^{-k}\,, \tag{47}$$

while the aggregate price level is summarized by equation (38) and

$$P^* = \frac{2k+1}{2k+2}\frac{(W^*)^\sigma N^*}{z^{*H}}\,. \tag{48}$$

Finally, the balance of payments condition in a zero trade balance steady state can be rewritten as

$$\frac{n}{1-n} = \frac{\lambda}{\lambda^*}\left(\frac{W^*}{W}\right)^{2\sigma}\epsilon^3\left(\frac{z^{*F}}{z^F}\right)^{(k+2)}\,, \tag{49}$$

To summarize, for a given n, the equilibrium in the model with two countries can be described by equations (34), (35), (37), (38), (45)-(49) with nine unknown variables $\{z^H, z^F, z^{*H}, z^{*H}, N, N^*, P, P^*, W\}$, taking foreign labor input as the numeraire ($W^* = 1$).

This system, however, can be further collapsed into three equations in three unknowns, namely, z^H, z^{*H} and W:

$$\alpha\gamma\frac{1-\theta}{\theta}z^H W = W^\sigma\left[\gamma + \frac{\eta}{2k+2}\left(\frac{1}{z^H}\right)^k\bar{M}\left(n + (1-n)\left(\frac{W^\sigma}{\tau\epsilon}\right)^k\right)\right]\,, \tag{50}$$

$$\alpha\gamma\frac{1-\theta}{\theta}z^{*H} = \left[\gamma + \frac{\eta}{2k+2}\left(\frac{1}{z^{*H}}\right)^k\bar{M}\left((1-n) + n\left(\frac{\epsilon}{\tau W^\sigma}\right)^k\right)\right]\,, \tag{51}$$

$$\frac{n}{1-n} = \frac{W^{2\sigma(k+1)-1}}{\epsilon^{2k+1}}\left(\frac{z^{*H}}{z^H}\right)^{(k+2)}\,. \tag{52}$$

As $n \to 0$, equation (51) simplifies to

$$\alpha\gamma\frac{1-\theta}{\theta}z^{*H} = \left[\gamma + \frac{\eta}{2k+2}\left(\frac{1}{z^{*H}}\right)^k\bar{M}\right]\,,$$

which solves for z^{*H} as a function only of parameters. I have, thus, proved the first assumption: the foreign domestic productivity cutoff is not affected by changes at Home for n small enough.

Note that due to the Pareto distribution assumption, z^{*H}, cannot fall below one, the minimum value for productivity. Therefore, I need distinguish between two different cases. Suppose

$$\alpha\gamma\frac{1-\theta}{\theta} < \gamma + \frac{\eta}{2k+2}\bar{M}\,, \tag{53}$$

then the solution to the above equation is larger than one. Once, I have solved for z^{*H}, the foreign demand for the domestic variety is given by

$$q^{*F}(z) = \frac{1}{\gamma + \eta N^*}\left(\alpha + \frac{\eta}{\gamma}\frac{\theta}{1-\theta}P^*\right) - \frac{\theta}{1-\theta}\frac{1}{\gamma}p^{*F}(z)\,, \tag{54}$$

where $N^* = \bar{M}\left(z^{*H}\right)^{-k}$ and P^* is a function of z^{*H} as given by equation (48), and, thus, constant.

Suppose, instead, the opposite is true, and the inequality given by equation (53) does not hold. In such a case, z^{*H} remains at one so that all foreign firms produce, $N^* = \bar{M}$. This also means, that the choke price for Foreign is not binding[10] and a new equation for the aggregate price level in Foreign is required. In particular, the new price level is given by

$$P^* = \left(\frac{2}{\bar{M}} - \frac{\eta}{\gamma + \eta N^*}\right)^{-1}\left[\frac{\alpha\gamma\frac{1-\theta}{\theta}}{\gamma + \eta N^*} + \frac{1}{b}\frac{k}{k+1}\right].$$

The rest of the argument follows: foreign demand for the domestic variety is given by equation (54) which implies that A and B in equation (52) are constants as none of the foreign variables *i.e.* z^{*H}, N^* and P^*, are affected by changes in Home.

B.3 Existence and Uniqueness of Steady State

This appendix solves for the steady state of the model and shows that it is unique provided $\bar{B} = 0$. To ease notation, I drop all time subscripts. The steady state is summarized by one equation in one unknown, which can be solved numerically provided parameter values.

Start by rewriting the wage equation in steady state as

$$\lambda = \frac{\theta}{\theta - 1}\frac{1}{W}\,. \tag{55}$$

Combine (34) and (38) to get

$$z^H\alpha\gamma = W^\sigma\lambda\left(\gamma + \frac{\eta}{2k+2}N\right)\,. \tag{56}$$

Rewrite z^F as a function of z^H, given equations (34) and (35),

$$z^H = \frac{\tau\epsilon}{W^\sigma}z^H\,, \tag{57}$$

and plug into equation (37)

$$N = \left(\frac{1}{z^H}\right)^k\left(M + M^*\left(\frac{W^\sigma}{\tau\epsilon}\right)^k\right)\,.$$

[10]The maximum price faced by foreign consumers is actually lower than the choke price they would be willing to pay.

which can now be combined with equation (55) and (56) such that

$$z^H \alpha\gamma = \frac{\theta}{\theta-1}\frac{1}{W^{1-\sigma}}\left(\gamma + \frac{\eta}{2k+2}\left(\frac{1}{z^H}\right)^k\left(M + M^*\left(\frac{W^\sigma}{\tau\epsilon}\right)^k\right)\right). \tag{58}$$

Next, note that in steady state the interest rate is given by $R = \frac{1}{\beta}$ and bond holdings are $B = \bar{B}$ (see equations (40) and (41) respectively). Imposing this on the balance of payment condition, (42), together with equations (36), (55) and (57), delivers

$$M\frac{A^{k+2}}{B^{k+1}}\frac{\epsilon^{k+1}}{(\tau W^\sigma)^k} - M^*\frac{\theta}{\theta-1}\frac{W^{\sigma(k+2)-1}}{\gamma}\frac{\left(z^H\right)^{-(k+2)}}{(\tau\epsilon)^k} = -2\left(k+2\right)\epsilon\frac{(1-\beta)}{\beta}\bar{B}. \tag{59}$$

Equation (59) can be rewritten in terms of z^H and then plugged into equation (58). This would deliver a system of one equation in one unknown: if the economy is embedded in a currency union, the exchange rate is equal to one and the unknown is W. If the economy has a floating arrangement, the wage level is equal to the target and the unknown is ϵ. In any case, there exists a steady state equilibrium.

Impose that trade balance holds in equilibrium ($\bar{B} = 0$). Equation (59) is simplified to

$$\frac{1}{z^H} = \left[\gamma\frac{\theta-1}{\theta}\frac{M}{M^*}\frac{A^{k+2}}{B^{k+1}}\frac{\epsilon^{k+2}}{W^{2\sigma(k+1)-1}}\right]^{\frac{1}{k+2}},$$

and can now substitute for z^H in equation (58) as follows

$$\alpha\gamma\frac{\theta-1}{\theta} = \left[\gamma\frac{\theta-1}{\theta}\frac{M}{M^*}\frac{A^{k+2}}{B^{k+1}}\frac{\epsilon^{k+2}}{W^{2\sigma(k+1)-1}}\right]^{\frac{1}{k+2}}\left[\gamma + \frac{\eta}{2k+2}\left[\gamma\frac{\theta-1}{\theta}\frac{M}{M^*}\frac{A^{k+2}}{B^{k+1}}\frac{\epsilon^{k+2}}{W^{2\sigma(k+1)-1}}\right]^{\frac{k}{k+2}}\left(M + M^*\left(\frac{w^\sigma}{\tau\epsilon}\right)^k\right)\right].$$

The left hand side is a positive constant. The right hand side is:

1. A monotonically decreasing function in W with positive limit of zero and a negative limit of $+\infty$ in the currency union regime.

2. A monotonically increasing function in ϵ with positive limit of $+\infty$ and a negative limit of zero in the currency union regime.

Thus, in both cases, there exists a unique solution.

B.4 TFP Growth Decomposition in the Model

This appendix provides the mapping from the model to the TFP growth decomposition exercise. Consistent with the results reported for the Spanish firm-level data, the object of interest is the labor-weighted aggregate TFP, which in the model is defined as:

$$Z_t^H = N_t^H \int_{z_t^H}^{\infty} s_t(z) z \, Z_t \, \frac{g(z)}{1 - G(z_t^H)} \, dz \,,$$

where $s_t(z) = \frac{l_t^H(z)}{L_t^H}$.

The change in aggregate productivity from period $t-1$ to period t according to the decomposition derived in Online Appendix B.4. is equal to

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

Suppose that $z_t^H < z_{t-1}^H$ i.e. there is only entry. The mapping to the model is the following:

$$\sum_{i \in C} s_{i,t-1} \Delta Z_{i,t}^H = z_{t-1}^H \left(Z_t - Z_{t-1} \right) \frac{k+2}{k} \,,$$

$$\sum_{i \in C} Z_{i,t-1}^H \Delta s_{i,t} = -z_{t-1}^H \, Z_{t-1} \frac{k+2}{k} \frac{\frac{z_{t-1}^H}{z_t^H} - 1}{k \left(\frac{z_{t-1}^H}{z_t^H} - 1 \right) + 2 \left(\frac{z_{t-1}^H}{z_t^H} - \frac{1}{2} \right)} \,,$$

$$\sum_{i \in C} \Delta s_{i,t} \Delta Z_{i,t}^H = -z_{t-1}^H \left(Z_t - Z_{t-1} \right) \frac{k+2}{k} \frac{\frac{z_{t-1}^H}{z_t^H} - 1}{k \left(\frac{z_{t-1}^H}{z_t^H} - 1 \right) + 2 \left(\frac{z_{t-1}^H}{z_t^H} - \frac{1}{2} \right)} \,,$$

$$s_t^N \left(Z_t^{H,N} - Z_t^{H,C} \right) = -\frac{(k+2)(k+1)}{k} \frac{Z_t}{z_t^H} \frac{\left(z_{t-1}^H - z_t^H \right)^2}{k \left(\frac{z_{t-1}^H}{z_t^H} - 1 \right) + 2 \left(\frac{z_{t-1}^H}{z_t^H} - \frac{1}{2} \right)} \,.$$

Suppose that $z_t^H > z_{t-1}^H$ i.e. there is only exit. The mapping to the model is the following:

$$\sum_{i \in C} s_{i,t-1} \Delta Z_{i,t}^H = z_t^H \left(Z_t - Z_{t-1} \right) \frac{k+2}{k} \frac{\frac{z_t^H}{z_{t-1}^H} + k \left(\frac{z_t^H}{z_{t-1}^H} - 1 \right)}{k \left(\frac{z_t^H}{z_{t-1}^H} - 1 \right) + 2 \left(\frac{z_t^H}{z_{t-1}^H} - \frac{1}{2} \right)} \,,$$

$$\sum_{i \in C} Z_{i,t-1}^H \Delta s_{i,t} = z_t^H Z_{t-1} \frac{k+2}{k} \left[1 - \frac{\frac{z_t^H}{z_{t-1}^H} + k \left(\frac{z_t^H}{z_{t-1}^H} - 1 \right)}{k \left(\frac{z_t^H}{z_{t-1}^H} - 1 \right) + 2 \left(\frac{z_t^H}{z_{t-1}^H} - \frac{1}{2} \right)} \right] \,,$$

$$\sum_{i \in C} \Delta s_{i,t} \Delta Z_{i,t}^H = z_t^H \left(Z_t - Z_{t-1} \right) \frac{k+2}{k} \left[1 - \frac{\frac{z_t^H}{z_{t-1}^H} + k \left(\frac{z_t^H}{z_{t-1}^H} - 1 \right)}{k \left(\frac{z_t^H}{z_{t-1}^H} - 1 \right) + 2 \left(\frac{z_t^H}{z_{t-1}^H} - \frac{1}{2} \right)} \right] \,,$$

$$s_{t-1}^X \left(Z_{t-1}^{H,X} - Z_{t-1}^{H,C} \right) = \frac{(k+2)(k+1)}{k} \frac{Z_{t-1}}{z_{t-1}^H} \frac{\left(z_t^H - z_{t-1}^H \right)^2}{k \left(\frac{z_t^H}{z_{t-1}^H} - 1 \right) + 2 \left(\frac{z_t^H}{z_{t-1}^H} - \frac{1}{2} \right)} \,.$$

C Extensions to the Model

C.1 A Second Factor of Production

This appendix describes a version of the baseline model that features physical capital as the second input in the production of differentiated varieties. In particular, the unit cost at time t for a firm with idiosyncratic productivity level z is now given by $\frac{c_t}{zZ_t}$, where:

$$c_t = \left(\frac{W_t}{\sigma}\right)^{\sigma} \left(\frac{\kappa_t}{1-\sigma}\right)^{1-\sigma}, \tag{60}$$

where κ_t is the rental price of capital.

The clearing of the capital market ensures that capital demanded by firms is equal to the constant stock supplied by households:

$$K^s = \frac{(1-\sigma)kb^k}{(k+2)(k+1)} \frac{M}{\kappa_t} \left(\frac{c_t}{Z_t}\right)^2 \left[\frac{\lambda_t}{\gamma}(z_t^H)^{-(k+2)} + \frac{B\tau^2}{\epsilon_t}(z_t^{*F})^{-(k+2)}\right]. \tag{61}$$

The rational expectations equilibrium of this extension is the set of stochastic processes $\{z_t^H, z_t^F, z_t^{*F}, IM_t, EX_t, L_t, N_t, B_t, R_t, P_t, \lambda_t, W_t, \kappa_t, c_t\}_{t=0}^{\infty}$ satisfying equations (3), (5), (12), (16), (18), (60), (61) and

$$\frac{z_t^H Z_t}{c_t}\left(\frac{\alpha\gamma}{\lambda_t} + \eta P_t\right) = \gamma + \eta N_t, \tag{62}$$

$$\frac{z_t^F}{\tau\epsilon_t c_t^*}\left(\frac{\alpha\gamma}{\lambda_t} + \eta P_t\right) = \gamma + \eta N_t, \tag{63}$$

$$z_t^{*F} Z_t = \frac{B}{A}\frac{\tau c_t}{\epsilon_t}, \tag{64}$$

$$P_t = \frac{2k+1}{2k+2}\frac{c_t N_t}{z_t^H Z_t}, \tag{65}$$

$$L_t = \frac{\sigma kb^k}{(k+1)(k+2)} \frac{M}{W_t} \left(\frac{c_t}{Z_t}\right)^2 \left[\frac{\lambda_t}{\gamma}(z_t^H)^{-(k+2)} + \frac{B\tau^2}{\epsilon_t}(z_t^{*F})^{-(k+2)}\right],$$

$$IM_t = \frac{b^k}{2(k+2)} M * \frac{\lambda_t}{\gamma}\left(\frac{\tau\epsilon_t c_t^*}{Z_t}\right)^2 \left(z_t^F\right)^{-(k+2)}, \tag{66}$$

$$EX_t = \frac{b^k}{2(k+2)} M \frac{B}{\epsilon_t}\left(\frac{\tau c_t}{Z_t}\right)^2 \left(z_t^{*F}\right)^{-(k+2)}, \tag{67}$$

given the exogenous process $\{\xi_t, Z_t\}_{t=0}^{\infty}$, initial conditions $\{R_{-1}, B_{-1}, W_[t-1\}$ and the central bank's policy $\{\epsilon_t\}_{t=0}^{\infty}$. The foreign marginal cost, c_t^*, is normalized to one.

The supply of capital is parameterized such that the steady state is the same as in the baseline model, $K^S = 0.0182$. All other parameters remain unchanged.

C.2 Imported Intermediate Inputs

This appendix describes a version of the baseline model that features domestic and imported intermediate inputs as factors of production. In particular, the unit cost at time t for a firm with idiosyncratic productivity level z is now given by $\frac{c_t}{zZ_t}$, where:

$$c_t = \left(\frac{W_t}{\sigma}\right)^{\sigma}\left(\frac{p_t^x}{1-\sigma}\right)^{1-\sigma}, \tag{68}$$

$$p_t^x = \left[W_t^{1-\chi} + \epsilon_t^{1-\chi}\right]^{\frac{1}{1-\chi}}. \tag{69}$$

The demand for domestic and foreign intermediate inputs follows from the firm's cost minimization problem such that:

$$x_t^H = \epsilon_t^{\chi}\left[\frac{1}{\epsilon_t^{\chi-1} + W_t^{\chi-1}}\right]^{\frac{1}{\chi-1}} \frac{(1-\sigma)kb^k}{(k+1)(k+2)}\frac{M}{p_t^x}\left(\frac{c_t}{Z_t}\right)^2\left[\frac{\lambda_t}{\gamma}(z_t^H)^{-(k+2)} + \frac{B\tau^2}{\epsilon_t}(z_t^{*F})^{-(k+2)}\right] \tag{70}$$

$$x_t^F = W_t^{\chi}\left[\frac{1}{\epsilon_t^{\chi-1} + W_t^{\chi-1}}\right]^{\frac{1}{\chi-1}} \frac{(1-\sigma)kb^k}{(k+1)(k+2)}\frac{M}{p_t^x}\left(\frac{c_t}{Z_t}\right)^2\left[\frac{\lambda_t}{\gamma}(z_t^H)^{-(k+2)} + \frac{B\tau^2}{\epsilon_t}(z_t^{*F})^{-(k+2)}\right] \tag{71}$$

The rational expectations equilibrium of this extension is the set of stochastic processes $\{z_t^H, z_t^F, z_t^{*F}, IM_t, EX_t, L_t, N_t, B_t, R_t, P_t, \lambda_t, W_t, c_t, p_t^x, x_t^H, x_t^F\}_{t=0}^{\infty}$ satisfying equations (3), (5), (12), (16), (62)-(71) and

$$L_t = \frac{\sigma kb^k}{(k+1)(k+2)}\frac{M}{W_t}\left(\frac{c_t}{Z_t}\right)^2\left[\frac{\lambda_t}{\gamma}(z_t^H)^{-(k+2)} + \frac{B\tau^2}{\epsilon_t}(z_t^{*F})^{-(k+2)}\right] + x_t^H,$$

$$EX_t - IM_t - \epsilon_t x_t^F = \epsilon_t(B_t - R_{t-1}B_{t-1}),$$

given the exogenous process $\{\xi_t, Z_t\}_{t=0}^{\infty}$, initial conditions $\{R_{-1}, B_{-1}, W_{t-1}\}$ and the central bank's policy $\{\epsilon_t\}_{t=0}^{\infty}$. The foreign marginal cost, c_t^*, is normalized to one.

There is only one new parameter: the elasticity of substitution between domestic and foreign intermediate inputs, χ. I follow Gopinath and Neiman (2014) in setting $\chi = 4$. I adjust the foreign demand parameters to match the same moments described in the benchmark calibration. This requires setting $A = 1.37$ and $B = 3.14$. All other parameters remain unchanged.

C.3 Long-run Analysis

This appendix describes a long-run version of the baseline model where the number of existing firms, M_t, is endogenous. The set-up follows Ottaviano (2012) in putting Melitz and Ottaviano (2008) in a DSGE framework. The key innovation is the introduction of capital which is supplied by a second sector, accumulated by consumers and required for the set-up of firms producing the differentiated varieties. In what follows, I highlight how these assumptions and new implications fit into the set-up presented in section 3.

The representative household As explained in the main text, the representative consumer is allowed to buy shares, x_t, of the economy's capital stock, K_t, at price, V_t. While capital is assumed to fully depreciate after one period; the investment entitles the representative consumer to a fraction of next period's aggregate firm profit. The consumer budget constraint is correspondingly adjusted to read:

$$\int_{\omega\in\Omega} p_t(\omega)\, q_t(\omega)\, d\omega + \epsilon_t B_t + x_t V_t K_t = \int_0^1 W_t^i L_t^i \, di + x_{t-1}\Pi_t + \epsilon_t R_{t-1} B_{t-1}\,.$$

Regarding the household's optimization problem, there is an additional optimality condition describing the purchase of capital shares. In particular:

$$1 = \beta E_t \left[\frac{\lambda_{t+1}}{\lambda_t} \frac{\Pi_{t+1}}{V_t K_t} \right] .$$

Capital investment is encouraged when the price of capital is low or when expected future returns are high. Given risk aversion, returns are adjusted by the stochastic discount factor: returns are more desirable whenever the marginal utility of income is higher.

Production of capital Capital is produced under perfect competition using a Cobb-Douglas technology that combines units of domestic labor, $l_t^{k,H}$ and foreign labor, $l_t^{k,F}$: $K_t = \left(l_t^{k,H}\right)^{\rho} \left(l_t^{k,F}\right)^{1-\rho}$.

Producers of capital choose labor inputs such that costs are minimized. For this analysis, only the demand for domestic labor is relevant,

$$l_t^{k,H} = \left(\frac{\rho}{1-\rho} \frac{\epsilon_t}{W_t} \right)^{1-\rho} K_t. \tag{72}$$

Production of differentiated varieties I assume that f_E units of capital are required for a firm to produce a differentiated variety. The timing is such that the fixed entry cost is due one period before the firm is able to start production. This implies that the realization of the firm's productivity draw is still unknown. The resulting free-entry condition pins down the number of firms that will be potentially active in period $t+1$, denoted by M_t:

$$M_t = \frac{K_t}{f_E}\,. \tag{73}$$

Aggregation and market clearing The number of active firms in the domestic market, N_t, has to be modified to account for the new timing assumption. In particular, the number of firms at time t will depend on the number of firms that paid the fixed capital requirement in period $t-1$ such that:

$$N_t = M_{t-1}\left(\frac{b}{z_t^H}\right)^k + M^*\left(\frac{b}{z_t^F}\right)^k. \tag{74}$$

Aggregate labor demand is augmented to include the domestic labor input used in the production of capital as given by equation (72), such that the labor market clearing condition now reads:

$$L_t = \frac{\sigma k b^k}{(k+1)(k+2)}\frac{M_{t-1}}{W_t}\left(\frac{W_t^\sigma}{Z_t}\right)^2\left[\frac{\lambda_t}{\gamma}\left(z_t^H\right)^{-(k+2)} + B\frac{\tau^2}{\epsilon_t}\left(z_t^{*F}\right)^{-(k+2)}\right] + \left(\frac{\rho}{1-\rho}\frac{\epsilon_t}{W_t}\right)^{1-\rho} f_E M_t\,, \tag{75}$$

where the free market condition, equation (73), is used to substitute for capital.

Given the capital investment decision, aggregate profit is now a variable of interest. It is computed by summing profits from domestic and export sales. More precisely,

$$\Pi_t = \frac{bk}{2(k+1)(k+2)}M_{t-1}\left(\frac{W_t^\sigma}{Z_t}\right)^2\left[\frac{\lambda_t}{\gamma}\left(z_t^H\right)^{-(k+2)} + B\frac{\tau^2}{\epsilon_t}\left(z_t^{*F}\right)^{-(k+2)}\right]. \tag{76}$$

A new market clearing condition for capital ensures that demand by consumers is equated to supply by producers. Given the perfect competition assumption, this simply implies that the price of capital is equal to its marginal cost. Formally,

$$V_t = \left(\frac{W_t}{\rho}\right)^\rho \left(\frac{\epsilon_t W_t^*}{1-\rho}\right)^{1-\rho}.$$

As the consumer's budget constraint has been modified, the resulting balance of payment condition is:

$$EX_t - IM_t + \epsilon_t B_{t-1}(R_{t-1}-1) = \epsilon_t\left(B_t - B_{t-1}\right) + \left(\frac{W_t}{\rho}\right)^\rho\left(\frac{\epsilon_t W_t^*}{1-\rho}\right)^{1-\rho}(1-\rho) f_e M_t\,, \tag{77}$$

where EM_t and IM_t, the total export and import revenues in domestic currency terms, are given by:

$$EX_t = \frac{b^k}{2(k+2)}M_{t-1}\frac{B}{\epsilon_t}\left(\frac{\tau W_t^\sigma}{Z_t}\right)^2\left(z_t^{*F}\right)^{-(k+2)}, \tag{78}$$

and equation (19) respectively. Note that the above balance of payment condition is derived by imposing that, in equilibrium, capital shares add up to one.

Solving the model The rational expectations equilibrium of this extension is the set of stochastic processes $\{z_t^H, z_t^F, z_t^{*F}, IM_t, EX_t, L_t, N_t, B_t, R_t, P_t, \lambda_t, W_t, M_{t-1}, \Pi_t\}_{t=0}^{\infty}$ satisfying equations (3), (5), (9)-(11), (13), (16), (19), (23), (74)-(78) given the exogenous process $\{\xi_t, Z_t\}_{t=0}^{\infty}$, initial conditions $\{R_{-1}, B_{-1}\}$ and the central bank's policy $\{\epsilon_t\}_{t=0}^{\infty}$. The foreign wage, W_t^*, is normalized to one.

This extension of the model is parameterized following the same principles as the baseline framework. The cost of entry is calibrated such that the economy starts at the same steady state as the baseline, $f_E = 4.1531e - 04$, and $\rho = 0.5$.

D Aggregate Data

D.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.[11]

To characterize the behavior of the macroeconomy as a sudden stop unfolds I use data on output, final private consumption, employment, TFP, current account deficit and real exchange rate. All variables are compiled from the World Development Indicators except for TFP that is collected from the Conference Board's Total Economy Database and the current account deficit from the IMF's World Economic Outlook Database.

D.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.

[11] 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.

- Identify reversal episodes as subsequent country-year observations that show reductions in the financial surplus half a standard deviation above 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.

- 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.

D.3 Robustness

This appendix presents robustness checks to the event study discussed in section 6. In the interest of space, only results for productivity are reported. Results for all other variables are available upon request.

D.3.1 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 arrangment) building from an existing *de facto* coding system put together by Ilzetzki, Reinhart and Rogoff (2019). In panel A of Figure A.14, 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. Panel B of Figure A.14 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 arrangemnt and it is completely unchanged under a currency union.

D.3.2 Alternative Detrending Methods

The focus of this literature is on the cyclical component of macroeconomic variables. This requires removing the trend of each raw time series prior to the event study. For the baseline results, I fit a linear trend to the pre-crisis data and extrapolate forward. In panel A of Figure A.15, I instead consider a more sophisticated (and popularized) detrending method: the Hodrick-Prescott (HP) filter. To prevent future states influencing current observations, I use the one-sided version. Given that the frequency of the data is annual, I set the smoothing parameter equal to 6.25. In a currency union, TFP remains almost constant during the sudden stop, while the collapse is significant in a floating arrangement. However, the magnitude of the decline is smaller and the recovery faster than in the baseline results. This is driven by the fact that a HP filter uses observations at $t-i$, $i > 0$ to construct the current time point t, while the baseline method uses the same set of observations for any t such that $t > -2$.

Panel B of Figure A.15 explores the role of the pre-crisis sample in shaping the results. While keeping the sample length constant, I shift the sample selection closer to the year the sudden stop hits. In particular, I calculate the linear trend using observations from periods $t-4$ to $t-1$. Results remain unchanged.[12]

D.3.3 Full Window Requirement

In order to account for changes in the composition of the sample, I redo the analysis including only episodes for which all six years of data are available. Figure A.16 shows that this restriction has no discernible effects on the baseline results.

D.3.4 Controlling for Development Level

The reader might be concerned that the exchange rate regime classification is picking up another dimension of heterogeneity across episodes. A legitimate candidate is the underlying degree of economic development of affected countries; the list of sudden stops under a currency union is dominated by rich economies. To address this issue, I conduct the analysis by restricting the sample to either advanced or emerging economies only. I use the IMF country classification as reported by the World Economic Outlook April 2018 release. In addition I manually code Haiti, Gabon, Rwanda, Sierra Leone and Moldova as developing economies.

Results for productivity are reported in Figure A.17. Note that given the reduction in the sample size, I collapse results for a currency union and a hard peg on the one hand, and results for a soft peg and a floating arrangement on the other. Panel A shows the behavior of TFP during a sudden stop in advanced economies. As in the baseline case, there is an increase, albeit non-significant, improvement in productivity when the exchange rate is fixed, either in a currency

[12] I have also explored changing the sample length on its own and together with a sample shift as discussed here.

union or a hard peg; while there is a clear decline when the exchange rate is more freely allowed to adjust.

Panel B depicts a fall in productivity during the sudden stops that take place in developing economies irrespective of the exchange rate regime in place. However, the decline in TFP is non-significant, with wider standard errors, and quantitatively smaller in the case of a currency union or hard peg. To some extent this is driven by the fact that almost all of the episodes here captured fall under the hard peg category (as opposed to currency unions).

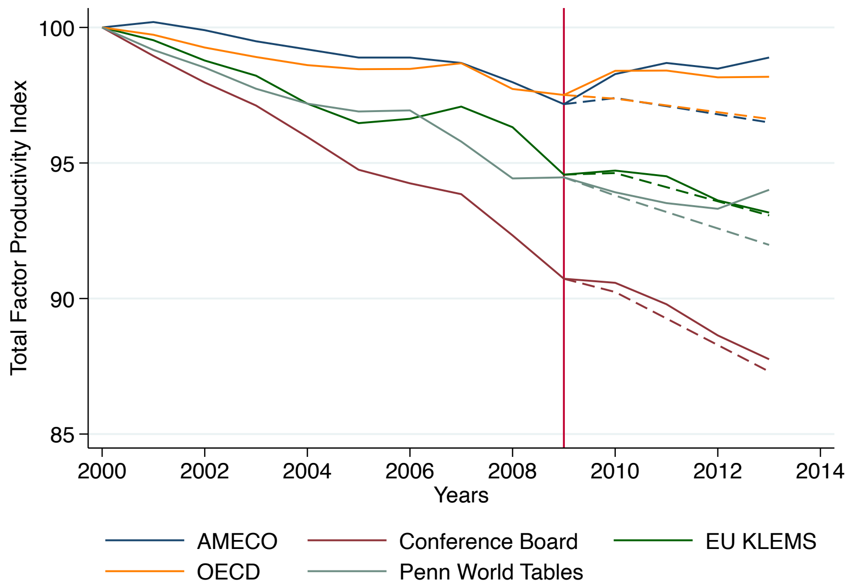
D.3.5 Controlling for the Type of Crisis

Two additional potential dimensions of heterogeneity across episodes are the type and the geographic scope of the crisis in which the sudden stop results. Regarding the former, it is recurrent in economic history that balance of payment crisis coincide in time with banking crisis. To evaluate whether the unison of crises plays a role, I control for the incidence of twin crises. In particular, I generate a dummy variable that equals one if, during a sudden stop, there is a year or a pair of consecutive years in which a banking and a currency crisis take place as reported by Laeven and Valencia (2018). Panel A of Figure A.18 shows that results are robust to controlling for twin crises.

Regarding the latter, sudden stops often take place in several countries simultaneously. To account for the synchronization of international capital flow cycles and spillovers risks, I control for the scope of the associated crisis i.e. whether it is global or regional (as opposed to local). I define the crisis as global if the global GDP growth rate is negative anytime between one year before and one year after the sudden stop's starting date, period $t = 0$. Similarly, I define the crisis as regional if the corresponding regional GDP growth rate is negative anytime between one year before and one year after the sudden stop's starting date, period $t = 0$. The associated crisis is local if it is not regional nor global. Global and regional GDP growth rates are collected from the IMF's World Economic Outlook. Results are reported in panel B of Figure A.18. Note that I group members of a currency union and hard peggers together on the one hand, and soft peggers and floaters on the other, to overcome the reduction in sample size. Once again, there are no major changes in the productivity plots.

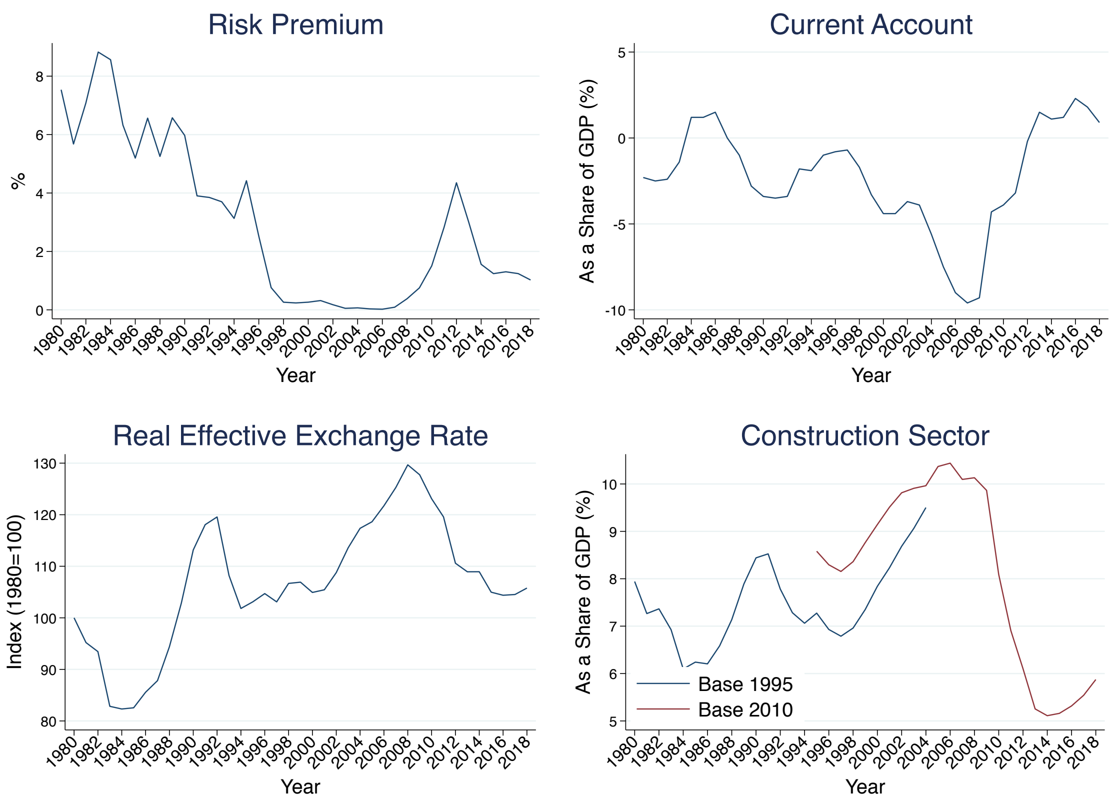
E Additional Figures

FIGURE A.1: TFP IN SPAIN - ALTERNATIVE SOURCES



Notes: This figure plots the evolution of aggregate TFP in Spain according to alternative data sources. The solid line shows the evolution of the actual time series while the dashed line corresponds to the extrapolation of a quadratic trend fitted on observations extending until 2009. The sources of the data are AMECO, Conference Board, EU KLEMS, OECD and Penn World Tables.

FIGURE A.2: EVOLUTION OF THE SPANISH ECONOMY

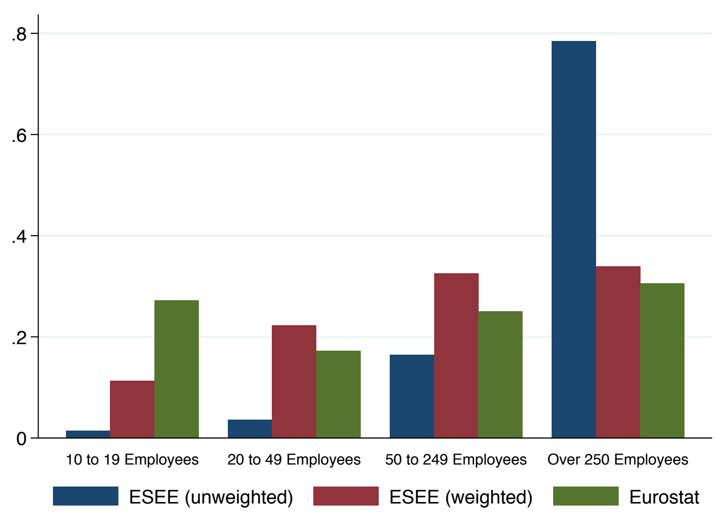


Notes: The first figure plots the evolution of the sovereign debt risk premium calculated as the difference between the Spanish and the German 10-year government bond yield. The second figure plots the evolution of the current account as a share of GDP. The third figure plots the real effective exchange rate (REER) calculated using unit labor costs. An increase in the REER index represents a real appreciation of the domestic currency. The fourth figure plots the evolution of value added in the construction sector as a share of GDP. The sources of the data are OECD, IMF and INE.

Figure A.3: Exit Rate by Year

Notes: This figure plots the exit rate defined as the share of firms that exit at t relative to the total number of firms at $t-1$. The data used is collected from the ESEE dataset.

Figure A.4: Share of Total Employment by Size Class

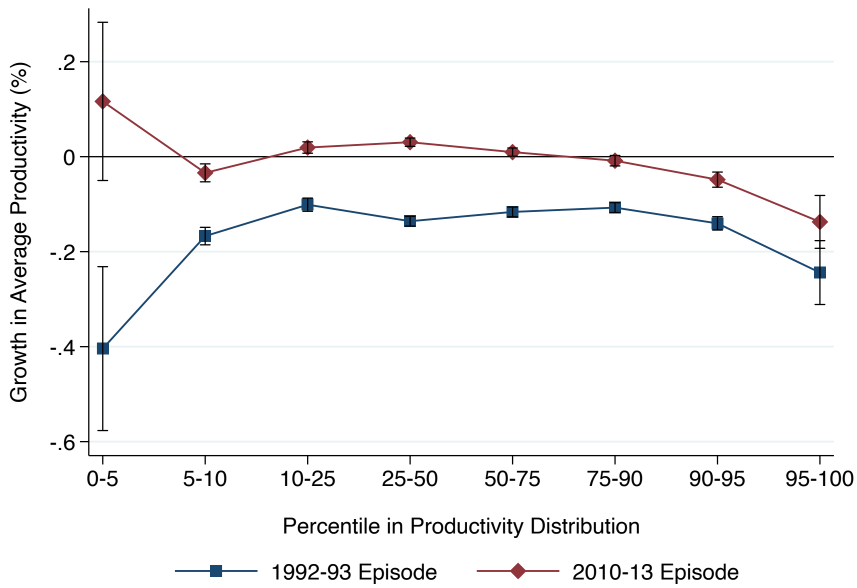


Notes: This figure plots the fraction of total employment accounted for by firms belonging to each size class. The blue and red bars report statistics from the ESEE dataset (unweighted and weighted correspondingly) and the green bar from Eurostat.

FIGURE A.5: MISALLOCATION

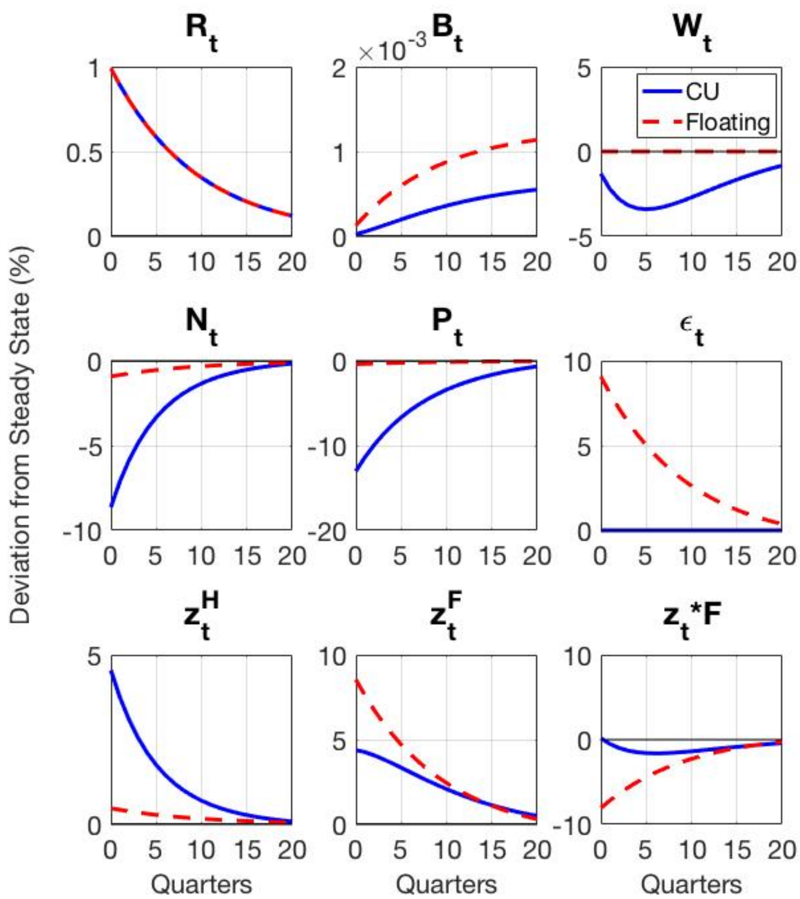
Notes: This figure plots the within-industry dispersion of the marginal revenue products of capital and labor over time using sampling weights described in Online Appendix A.7. The numbers depicted are relative to 2000, which is normalized to one. Marginal revenue products are measured at the firm-level according to the Hsieh and Klenow (2009) framework. Standard deviations at the sector level are aggregated using time-invariant employment weights. The data used is collected from the ESEE dataset.

FIGURE A.6: PRODUCTIVITY GROWTH ACROSS THE DISTRIBUTION WITH SAMPLING WEIGHTS



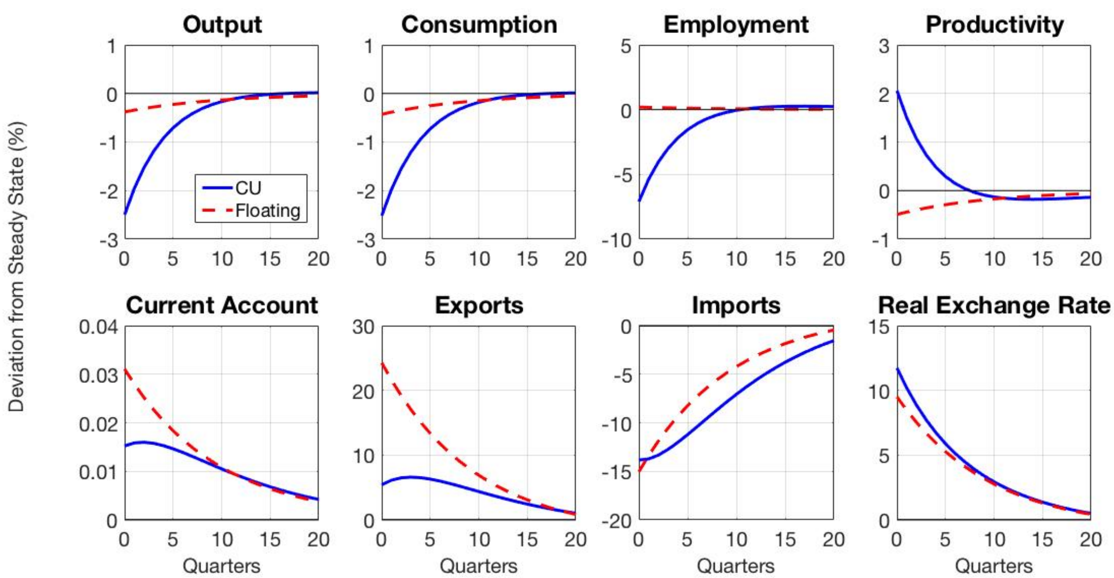
Notes: This graph plots the growth in average TFP by percentile of the productivity distribution. It compares the average TFP of firms in a given percentile before and after each of the two sudden stops. As this is an unbalanced panel, firms are allowed to change percentiles and even exit the sample during the transition. The corresponding base and end years are 1991 and 1993 for the first episode; 2009 and 2013 for the second episode. To account for variability, the vertical lines represent error bands. The data used is collected from the ESEE dataset.

FIGURE A.7: BASELINE MODEL - OTHER VARIABLES



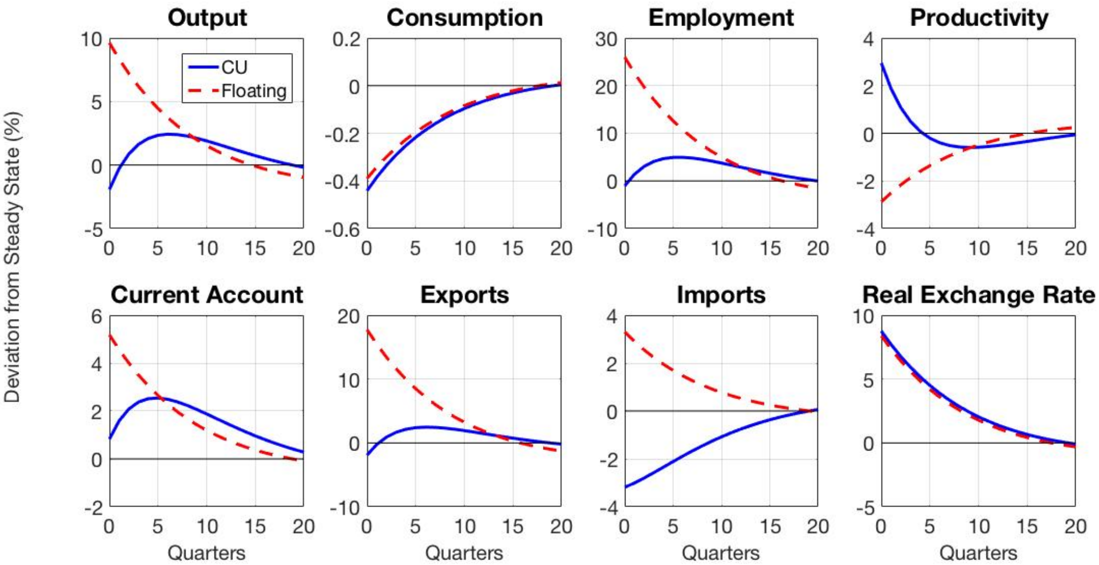
Notes: These figures plot the impulse response functions of additional macroeconomic variables to a one percentage point increase to the country-specific risk premium and a one percentage point decrease to the common TFP shifter as predicted by the model described in section 3. All variables but debt holdings are expressed in log deviations from steady state. The level of debt, assumed to be zero in steady state, is expressed in levels. The interest rate, R_t, and the level of debt, B_t, are denominated in foreign currency; the wage, W_t and price level, P_t are denominated in domestic currency; the nominal exchange rate, ϵ_t, is defined as domestic currency per unit of foreign currency; all other variables are expressed in real terms.

FIGURE A.8: A MODEL WITH CAPITAL



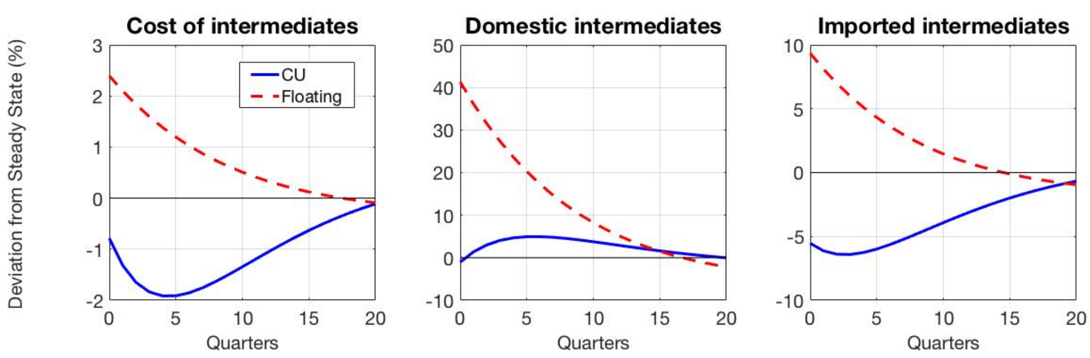
Notes: These figures plot the impulse response functions of key macroeconomic variables to a one percentage point increase to the country-specific risk premium and a one percentage point decrease to the common TFP shifter in a version of the model featuring physical capital as described in Appendix C.1. All variables but the current account are expressed in log deviations from steady state. The current account, assumed to be zero in steady state, is expressed in levels. The current account, exports and imports are denominated in domestic currency; all other variables are expressed in real terms.

FIGURE A.9: A MODEL WITH IMPORTED INTERMEDIATE INPUTS



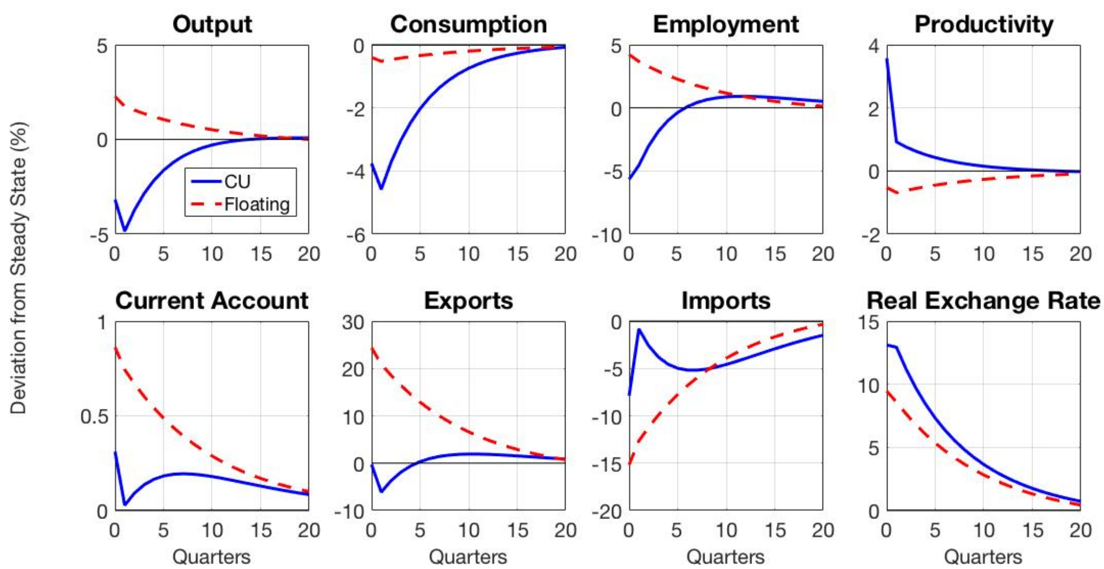
Notes: These figures plot the impulse response functions of key macroeconomic variables to a one percentage point increase to the country-specific risk premium and a one percentage point decrease to the common TFP shifter in a version of the model featuring imported intermediate inputs as described in Appendix C.2. All variables but the current account are expressed in log deviations from steady state. The current account, assumed to be zero in steady state, is expressed in levels. The current account, exports and imports are denominated in domestic currency; all other variables are expressed in real terms.

FIGURE A.10: A MODEL WITH IMPORTED INTERMEDIATE INPUTS - OTHER VARIABLES



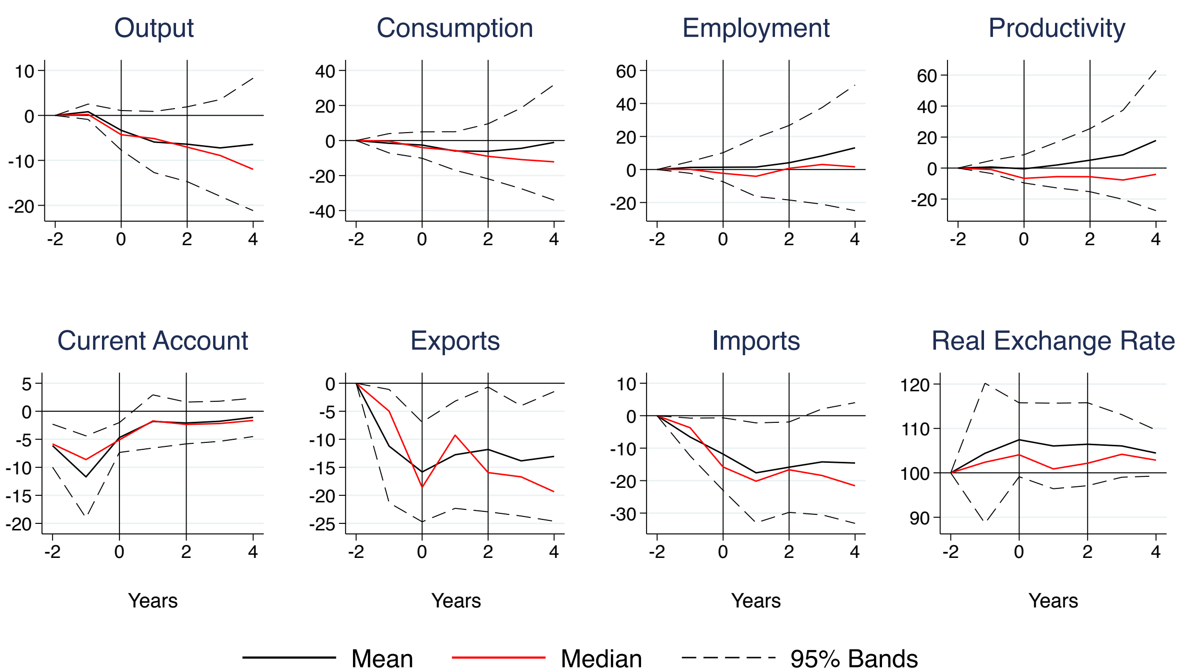
Notes: These figures plot the impulse response functions of the marginal cost and the demand for intermediate inputs to a one percentage point increase to the country-specific risk premium and a one percentage point decrease to the common TFP shifter in a version of the model featuring imported intermediate inputs as described in Appendix C.2. Variables are expressed in log deviations from steady state. The cost of intermediates is denominated in domestic currency while the demand for intermediate inputs is in real terms.

FIGURE A.11: LONG-RUN VERSION OF THE MODEL



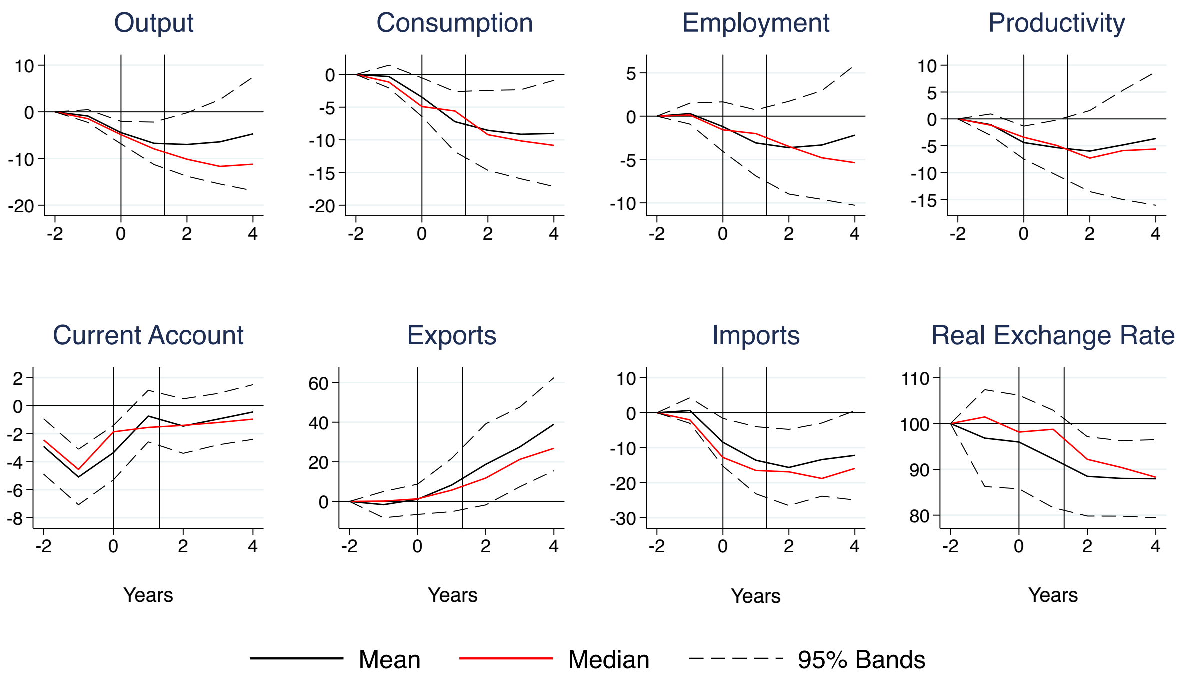
Notes: These figures plot the impulse response functions of key macroeconomic variables to a one percentage point increase to the country-specific risk premium and a one percentage point decrease to the common TFP shifter in the long run version of the model as described in Appendix C.3. All variables but the current account are expressed in log deviations from steady state. The current account, assumed to be zero in steady state, is expressed in levels. The current account, exports and imports are denominated in domestic currency; all other variables are expressed in real terms.

FIGURE A.12: A SUDDEN STOP UNDER A HARD PEG



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, productivity, exports and imports are expressed in terms of percentage deviations from an extrapolated linear trend calculated from periods $t-5$ to $t-2$. 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.

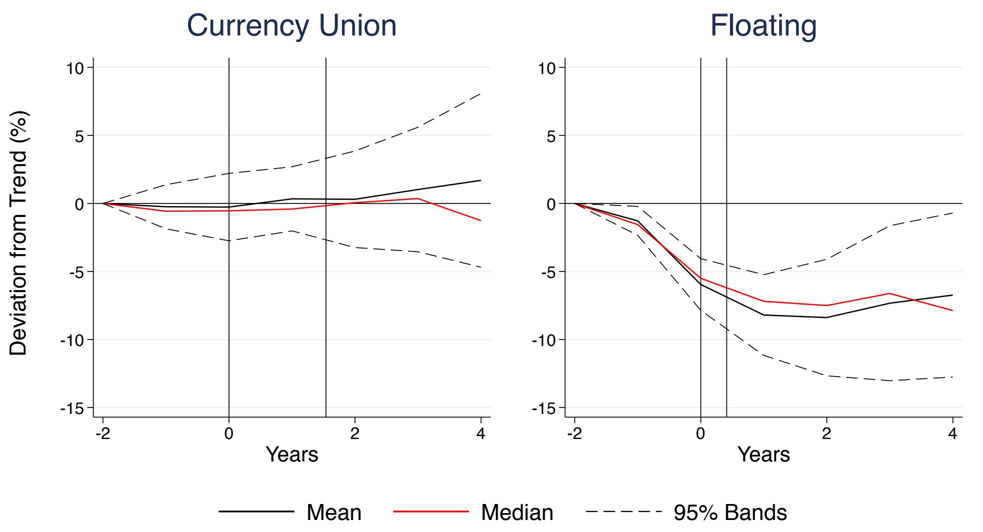
FIGURE A.13: A SUDDEN STOP UNDER A SOFT PEG



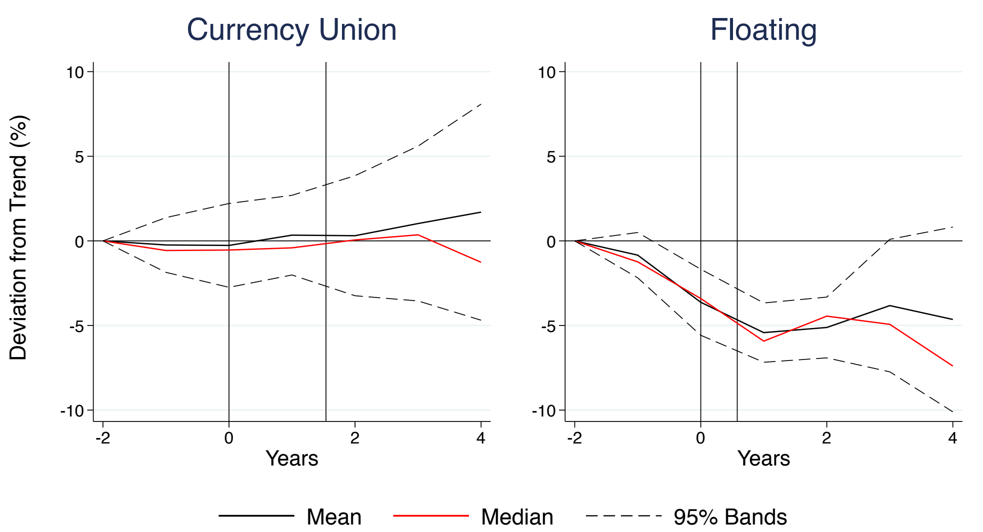
Notes: This figure plots the response of macroeconomic variables to a sudden stop under a soft peg. The black and red solid lines depict the mean and median path of the corresponding variables while the black dashed lines represent standard error bands. The two vertical lines show the start and end of an average episode. Output, consumption, employment, productivity, exports and imports are expressed in terms of percentage deviations from an extrapolated linear trend calculated from periods $t-5$ to $t-2$. 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.14: PRODUCTIVITY IN A SUDDEN STOP - EXCHANGE RATE CLASSIFICATION

PANEL A: USING KLEIN AND SHAMBAUGH (2008) CODING SYSTEM



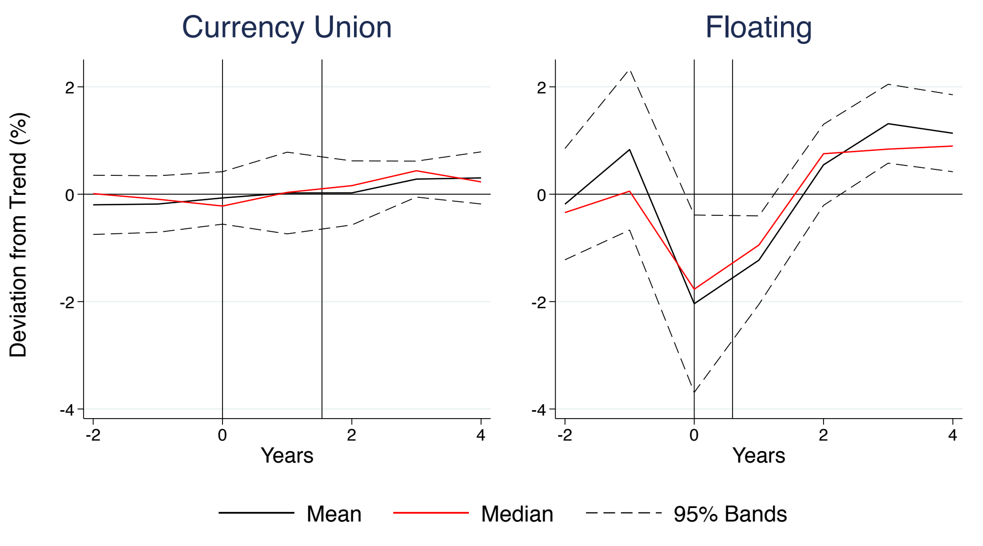
(b) PANEL B: USING PRE-SUDDEN STOP EXCHANGE RATE REGIME



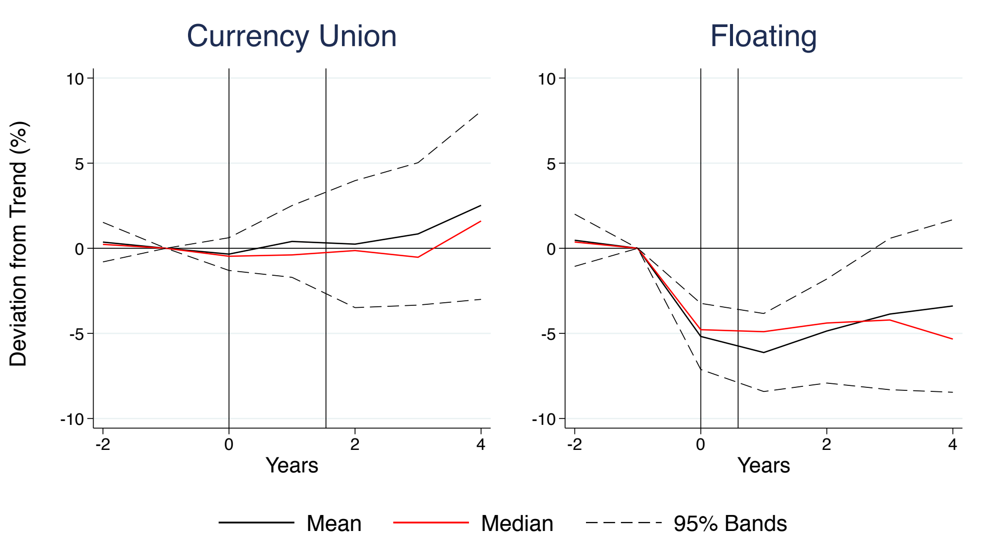
Notes: This figure plots the response of productivity to a sudden stop using alternative exchange rate classifications. Panel A builds on the coding system by Klein and Shambaugh (2008), instead of Ilzetzki, Reinhart and Rogoff (2019). Panel B considers the exchange rate regime in place one year before the sudden stop as the prevalent exchange rate regime. The first column reports sudden stops under a currency union and the second column sudden stops under a floating arrangement. 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 in terms of percentage deviations from an extrapolated linear trend calculated from periods $t-5$ to $t-2$. The sources of the data are IFS, WDI and the Total Economy Database.

FIGURE A.15: PRODUCTIVITY IN A SUDDEN STOP - DETRENDING METHODS

PANEL A: ONE-SIDED HODRICK-PRESCOTT FILTER

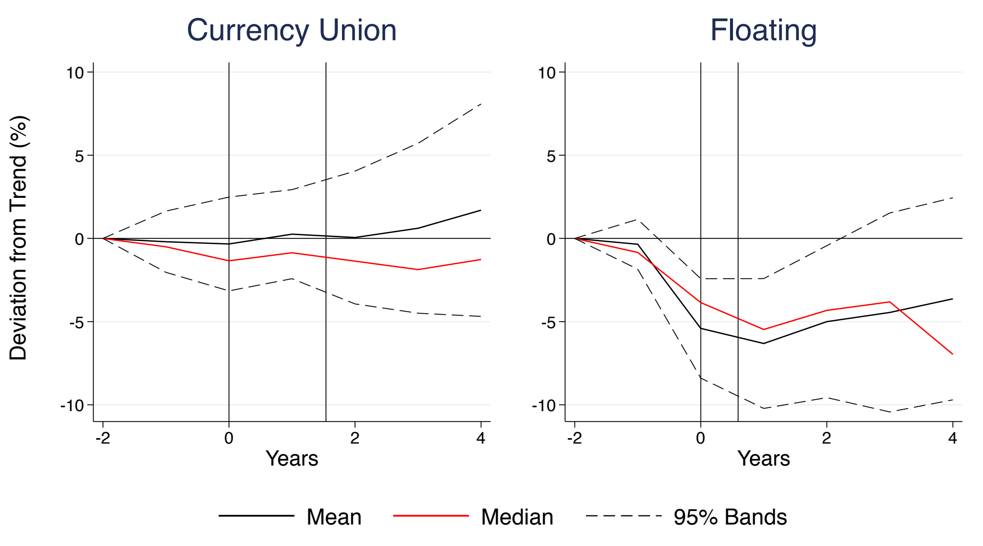


(b) PANEL B: ALTERNATIVE PRE-CRISIS SAMPLE



Notes: This figure plots the response of productivity to a sudden stop using alternative detrending methods. In panel A productivity is expressed in terms of percentage deviations from a one-sided Hodrick-Prescott filter with smoothing parameter set to 6.25. In panel B productivity is expressed in terms of percentage deviations from an extrapolated linear trend calculated from periods $t-4$ to $t-1$. The first column reports sudden stops under a currency union or hard peg and the second column sudden stops under a soft peg or floating arrangement. 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. The sources of the data are IFS, WDI and the Total Economy Database.

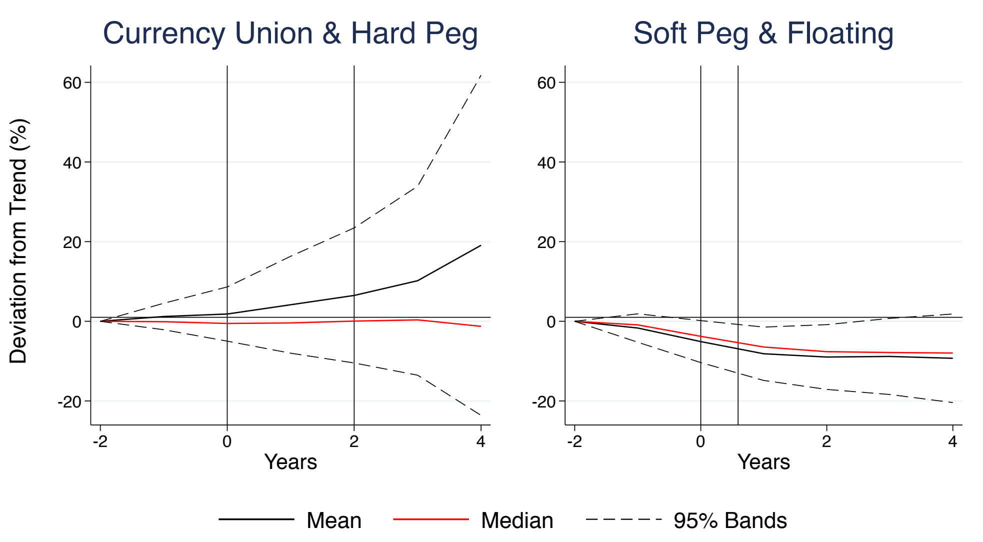
FIGURE A.16: PRODUCTIVITY IN A SUDDEN STOP - FULL WINDOW REQUIREMENT



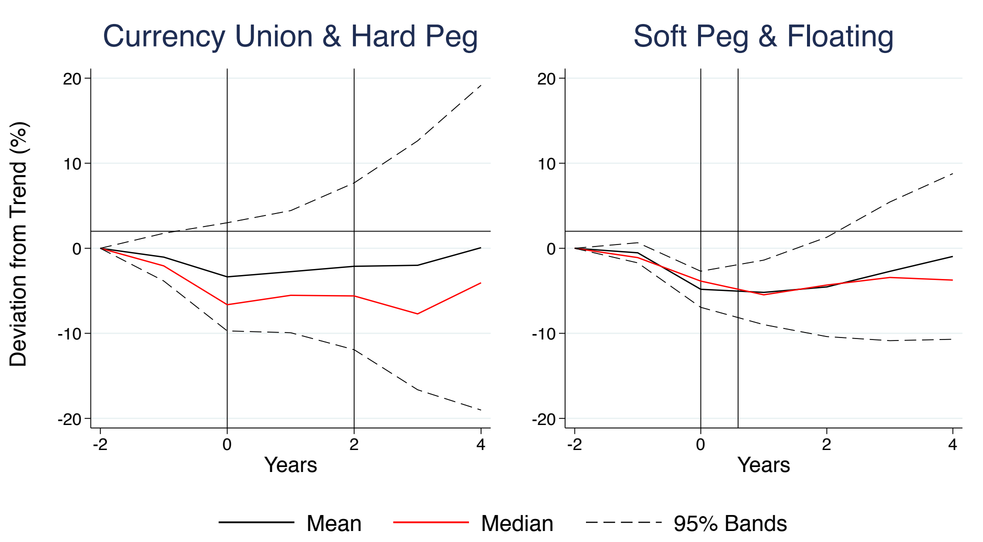
Notes: This figure plots the response of productivity to a sudden stop. The sample is restricted to include only episodes for which there is data for all six years. The first column reports sudden stops under a currency union or hard peg and the second column sudden stops under a soft peg or floating arrangement. 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 in terms of percentage deviations from an extrapolated linear trend calculated from periods $t-5$ to $t-2$. The source of the data areIFS, WDI and the Total Economy Database.

FIGURE A.17: PRODUCTIVITY IN A SUDDEN STOP - LEVEL OF ECONOMIC DEVELOPMENT

PANEL A: ADVANCED ECONOMIES



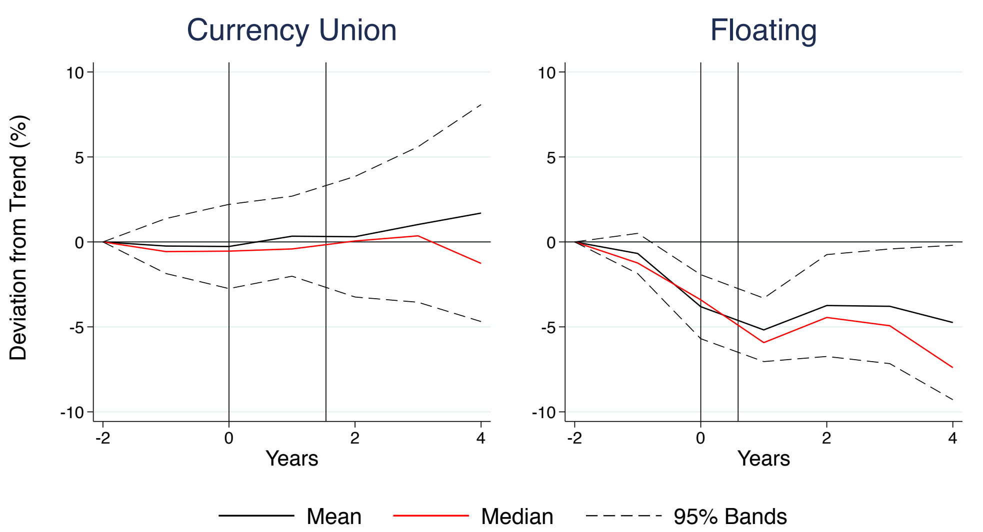
PANEL B: DEVELOPING ECONOMIES



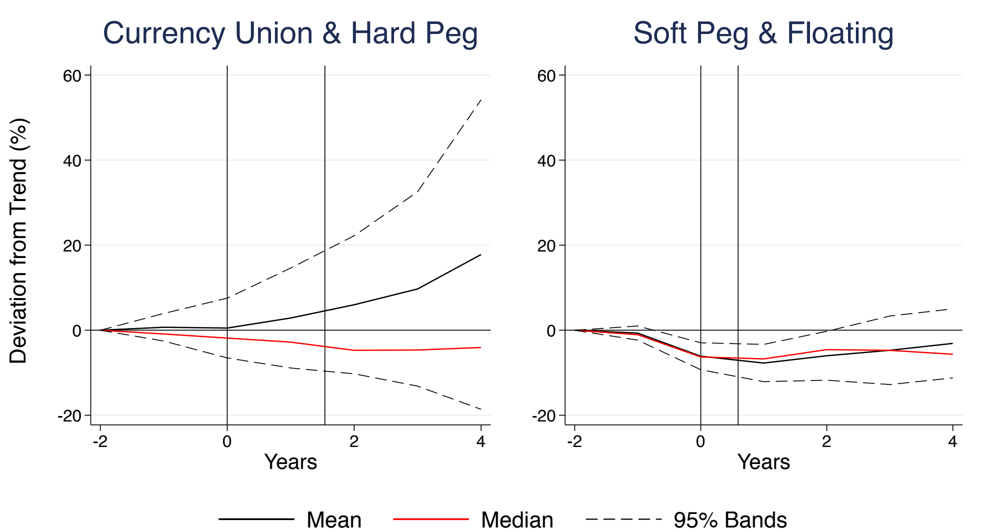
Notes: This figure plots the response of productivity to a sudden stop. The sample is restricted to advanced economies in Panel A and developing economies in Panel B as classified by the IMF. The first column reports sudden stops under a currency union or hard peg and the second column sudden stops under a soft peg or floating arrangement. 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 in terms of percentage deviations from an extrapolated linear trend calculated from periods $t-5$ to $t-2$. The sources of the data are IFS, WDI and the Total Economy Database.

FIGURE A.18: PRODUCTIVITY IN A SUDDEN STOP - TYPE OF CRISIS

PANEL A: CONTROLLING FOR TWIN CRISES



PANEL B: CONTROLLING FOR GEOGRAPHIC SCOPE



Notes: This figure plots the response of productivity to a sudden stop. Panel A controls for the incidence of a twin crisis defined as a simultaneous currency and banking crisis. Panel B controls for the scope of the crisis, i.e., whether it is global or regional (as opposed to local). The first column reports sudden stops under a currency union and the second column sudden stops under a floating arrangement. 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 in terms of percentage deviations from an extrapolated linear trend calculated from periods $t-5$ to $t-2$. The sources of the data are IFS, WDI and the Total Economy Database.

F Additional Tables

TABLE A.1: MOMENTS OF THE PRODUCTIVITY DISTRIBUTION

	1992-93 Episode		2010-13 Episode	
	Pre-sudden Stop	Sudden Stop	Pre-sudden Stop	Sudden Stop
Mean	0.28	0.14	0.11	0.12
Mode	0.29	0.17	0.14	0.16
St. Dev.	0.58	0.62	0.69	0.62
Skewness	-0.40	-1.24	-2.37	-0.89
Kurtosis	7.04	10.42	27.92	7.13
Min	-3.73	-5.28	-9.07	-3.68
Max	2.58	2.40	2.49	2.49

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.2: Decomposition of Productivity Growth Using Value-added Weights

	Sudden Stops	
	1992-1993	2010-2013
Productivity Growth (%)	-10.13	10.91
Contribution to Productivity Growth		
Incumbents' Contribution	**-9.69**	**6.59**
Within-firm Contribution	-18.75	-12.02
Between-firm Contribution	-10.48	-6.98
Cross-term Contribution	19.54	25.6
Net Entry Contribution	**-0.44**	**4.31**
Entrants' Contribution	-1.35	-1.35
Exiters' Contribution	0.91	5.17

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. 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 A.5. The data used is collected from the ESEE dataset.

Table A.3: Annualized Decomposition of Productivity Growth

	Sudden Stops	
	1992-1993	2010-2013
Productivity Growth (%)	-5.44	2.50
Contribution to Productivity Growth		
Incumbents' Contribution	**-5.73**	**0.33**
Within-firm Contribution	-5.24	-0.31
Between-firm Contribution	0.43	1.45
Cross-term Contribution	-0.92	-0.81
Net Entry Contribution	**0.29**	**2.18**
Entrants' Contribution	-0.54	-0.05
Exiters' Contribution	0.83	2.23

Notes: Productivity growth refers to the average year-on-year growth for the stated period. 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 A.5. The data used is collected from the ESEE dataset.

TABLE A.4: FIRM EXIT AND PRODUCTIVITY WITH ADDITIONAL CONTROLS II

	(1)	(2)	(3)	(4)	(5)
TFP_{it}	-0.020***	-0.020***	-0.021***	-0.016***	-0.016***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)
$ss^1_{t+1} * TFP_{it}$	-0.004	-0.004	-0.007	-0.005	-0.010
	(0.014)	(0.014)	(0.017)	(0.013)	(0.015)
$ss^2_{t+1} * TFP_{it}$	-0.038***	-0.036***	-0.039***	-0.032***	-0.032***
	(0.010)	(0.009)	(0.010)	(0.008)	(0.008)
$intrate_{it}$		-0.000			0.000
		(0.001)			(0.001)
$ss^1_{t+1} * intrate_{it}$		0.001			0.001
		(0.001)			(0.001)
$ss^2_{t+1} * intrate_{it}$		0.004*			0.005*
		(0.002)			(0.002)
$\Delta sales_{it}$			-0.009*		-0.010*
			(0.005)		(0.005)
$ss^1_{t+1} * \Delta sales_{it}$			0.022*		0.030**
			(0.012)		(0.013)
$ss^2_{t+1} * \Delta sales_{it}$			0.004		0.006
			(0.006)		(0.006)
ROE_{it}				-0.000	-0.000
				(0.000)	(0.000)
$ss^1_{t+1} * ROE_{it}$				-0.000	-0.000
				(0.000)	(0.000)
$ss^2_{t+1} * ROE_{it}$				0.002*	0.003**
				(0.001)	(0.001)
Observations	36,261	34,817	32,268	34,318	30,830
Year FE	Yes	Yes	Yes	Yes	Yes
Firm Size FE	Yes	Yes	Yes	Yes	Yes

Notes: All regressions are linear probability models where exit=1 if the firm reports positive activity in period t and no activity in period $t+1$. TFP_{it} is the log firm-level TFP at time t, ss^1_{t+1} is a dummy equal to one for years 1992-1993 and ss^2_{t+1} is a dummy equal to one for years 2010-2013. $intrate_{it}$ measures the average cost of long-term debt. $\Delta sales_{it}$ is the growth in sales between periods $t-1$ and t. ROE_{it} is the return on equity. Firm size classes in period t are used to control for firm size effects. Standard errors (in parentheses) are clustered at the year level; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

TABLE A.5: DISPERSION OF MARGINAL REVENUES PRODUCTS - ECONOMY-WIDE

	1992-93 Episode		2010-13 Episode	
	Pre-sudden Stop	Sudden Stop	Pre-sudden Stop	Sudden Stop
Dispersion of Capital	1.125	1.063	1.178	1.112
Dispersion of Labor	0.422	0.460	0.577	0.474

Notes: This table summarizes the weighted average of within-sector standard deviations of marginal revenue products of capital and labor. 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.6: DECOMPOSITION OF PRODUCTIVITY GROWTH WITH SAMPLING WEIGHTS

	Sudden Stops	
	1992-1993	2010-2013
Productivity Growth (%)	-15.31	3.59
Contribution to Productivity Growth		
Incumbents' Contribution	**-14.78**	**-4.99**
Within-firm Contribution	-12.24	-6.78
Between-firm Contribution	-2.50	1.86
Cross-term Contribution	-0.03	-0.06
Net Entry Contribution	**-0.53**	**8.58**
Entrants' Contribution	-1.71	-0.31
Exiters' Contribution	1.18	8.89

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. 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 A.5. The data used is collected from the ESEE dataset.

TABLE A.7: REALLOCATION AND PRODUCTIVITY WITH SAMPLING WEIGHTS

	Exit	Labor Growth (Incumbent & Exiters)	Labor Growth (Incumbents Only)
	(1)	(2)	(3)
TFP_{it}	-0.026	0.037***	0.022***
	(0.019)	(0.002)	(0.005)
$ss^1_{t+1} * TFP_{it}$	0.005	-0.015**	-0.005
	(0.023)	(0.007)	(0.011)
$ss^2_{t+1} * TFP_{it}$	-0.041**	0.011	0.015**
	(0.019)	(0.009)	(0.007)
Observations	36,261	32,268	28,275
Year FE	Yes	Yes	Yes
Firm Size FE	Yes	Yes	Yes

Notes: Regression for exit is a linear probability model where exit=1 if the firm reports positive activity in period t and no activity 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, ss^1_{t+1} is a dummy equal to one for years 1992-1993 and ss^2_{t+1} is a dummy equal to one for years 2010-2013. Firm size classes in period t are used to control for firm size effects. Observations are weighted using sampling weights. Standard errors (in parentheses) are clustered at the year level; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

TABLE A.8: FIRM EXIT AND PRODUCTIVITY WITH ADDITIONAL CONTROLS - SAMPLING WEIGHTS

	(1)	(2)	(3)	(4)	(5)
TFP_{it}	-0.027	-0.026	-0.023	-0.025	-0.022
	(0.018)	(0.018)	(0.014)	(0.017)	(0.013)
$ss^1_{t+1} * TFP_{it}$	0.008	0.003	0.000	0.005	-0.002
	(0.023)	(0.023)	(0.020)	(0.022)	(0.020)
$ss^2_{t+1} * TFP_{it}$	-0.040**	-0.042**	-0.029*	-0.038**	-0.028*
	(0.019)	(0.019)	(0.015)	(0.018)	(0.014)
$cons_i$		0.053			0.028
		(0.040)			(0.020)
$ss^1_{t+1} * cons_i$		-0.166**			-0.165*
		(0.077)			(0.090)
$ss^2_{t+1} * cons_i$		-0.040			-0.092
		(0.083)			(0.114)
$leverage_{it}$			0.000		0.000
			(0.000)		(0.000)
$ss^1_{t+1} * leverage_{it}$			0.000		0.000
			(0.000)		(0.000)
$ss^2_{t+1} * leverage_{it}$			0.000		0.000
			(0.000)		(0.000)
$importer_{it}$				-0.013	-0.009
				(0.014)	(0.010)
$ss^1_{t+1} * importer_{it}$				-0.002	-0.009
				(0.017)	(0.017)
$ss^2_{t+1} * importer_{it}$				-0.024	-0.021
				(0.018)	(0.015)
Observations	36,261	36,261	34,307	36,261	34,307
Year FE	Yes	Yes	Yes	Yes	Yes
Firm Size FE	Yes	Yes	Yes	Yes	Yes

Notes: All regressions are linear probability models where exit=1 if the firm reports positive activity in period t and no activity in period $t+1$. TFP_{it} is the log firm-level TFP at time t, ss^1_{t+1} is a dummy equal to one for years 1992-1993 and ss^2_{t+1} is a dummy equal to one for years 2010-2013. $cons_i$ measures the exposure of firm i to the construction sector according to the sector it operates in. $leverage_{it}$ is captured by the debt-to-assets ratio. $importer_{it}$ is a dummy equal to one if the firm reports any positive imported value. Firm size classes in period t are used to control for firm size effects. Observations are weighted using sampling weights. Standard errors (in parentheses) are clustered at the year level; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

TABLE A.9: DECOMPOSITION OF PRODUCTIVITY GROWTH USING ORBIS

	Sudden Stop 2010-2013
Productivity Growth (%)	8.83
Contribution to Productivity Growth	
Incumbents' Contribution	**2.20**
Within-firm Contribution	-1.28
Between-firm Contribution	1.89
Cross-term Contribution	1.59
Net Entry Contribution	**6.63**
Entrants' Contribution	-0.19
Exiters' Contribution	6.82

Notes: Productivity growth refers to accumulated TFP growth for the stated period. Base and final years are 2009 and 2013. 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 A.5. The data used is collected from ORBIS.

TABLE A.10: REALLOCATION AND PRODUCTIVITY USING ORBIS

	Exit (1)	Labor Growth (Incumbent & Exiters) (2)	Labor Growth (Incumbents Only) (3)
TFP_{it}	-0.049**	0.033***	0.026***
	(0.017)	(0.005)	(0.007)
$ss^2_{t+1} * TFP_{it}$	-0.060***	-0.005	0.001
	(0.021)	(0.007)	(0.010)
Observations	43,286	26,435	17,204
Year FE	Yes	Yes	Yes
Firm Size FE	Yes	Yes	Yes

Notes: Regression for exit is a linear probability model where exit=1 if the firm reports positive activity in period t and no activity 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^2_{t+1} is a dummy equal to one for years 2010-2013. Firm size classes in period t are used to control for firm size effects. Standard errors (in parentheses) are clustered at the year level; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

TABLE A.11: FIRM EXIT AND PRODUCTIVITY WITH ADDITIONAL CONTROLS USING ORBIS

	(1)	(2)	(3)	(4)
TFP_{it}	-0.049**	-0.049**	-0.044*	-0.044*
	(0.017)	(0.017)	(0.020)	(0.019)
$ss^2_{t+1} * TFP_{it}$	-0.060***	-0.054***	-0.082***	-0.080***
	(0.021)	(0.021)	(0.024)	(0.024)
$cons_i$		-0.113		-0.115
		(0.111)		(0.081)
$ss^2_{t+1} * cons_i$		0.238		0.245*
		(0.133)		(0.114)
$leverage_{it}$			0.017***	0.017***
			(0.004)	(0.004)
$ss^2_{t+1} * leverage_{it}$			0.000	0.000
			(0.008)	(0.008)
Observations	43,286	43,286	25,751	25,751
Year FE	Yes	Yes	Yes	Yes
Firm Size FE	Yes	Yes	Yes	Yes

Notes: All regressions are linear probability models where exit=1 if the firm reports positive activity in period t and no activity in period $t+1$. TFP_{it} is the log firm-level TFP at time t and ss^2_{t+1} is a dummy equal to one for years 2010-2013. $cons_i$ measures the exposure of firm i to the construction sector according to the sector it operates in. $leverage_{it}$ is captured by the debt-to-assets ratio. Firm size classes in period t are used to control for firm size effects. Standard errors (in parentheses) are clustered at the year level; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

TABLE A.12: MARKUPS AND PRODUCTIVITY USING ORBIS

	(1)	(2)
Firm-level TFP	1.002***	1.000***
	(0.005)	(0.005)
Aggregate TFP	-0.114*	
	(0.061)	
Industry TFP		-0.838***
		(0.145)
Observations	49,125	49,125
R-squared	0.808	0.782
Industry FE	Yes	Yes

Notes: This table reports the results of a cross-section regression of firm-level markups on different measures of productivity: at the firm level, at the industry level and at the economy level. All variables are measured in logs. Standard errors (in parentheses) are clustered by industry; $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.10$.

TABLE A.13: 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.14: DECOMPOSITION OF PRODUCTIVITY GROWTH WITH NO ENTRY

	Sudden stops	
	1992-1993	2010-2013
Productivity Growth (%)	-10.10	10.73
Contribution to Productivity Growth		
Incumbents' Contribution	**-11.20**	**3.05**
Within-firm Contribution	-9.69	-2.41
Between firm Contribution	0.47	3.75
Cross-term Contribution	-1.98	1.71
Net Entry Contribution	**1.10**	**7.68**
Entrants' Contribution	-	-
Exiters' Contribution	1.10	7.68

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. Sample is restricted to firms that were operating in 1991 and 2009 respectively. 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. Details of the formal decomposition can be found in Online Appendix A.5. The data used is collected from the ESEE dataset.

TABLE A.15: 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 D.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 6. The data used is collected from the IMF's World Economic Outlook database and Ilzetzki, Reinhart and Rogoff (2019).

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