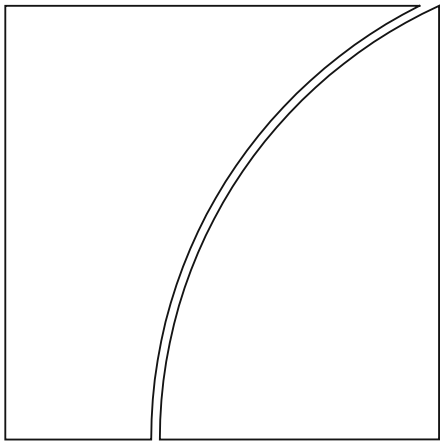

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by Boris Hofmann, Xiaoxi Liu and Ilhyock Shim

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Zombie Firms in Emerging Asia: Domestic and Cross-Border Implications*

Boris Hofmann† Xiaoxi Liu‡ Ilhyock Shim§

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Abstract

Using firm-bank linked data for 10 Asian emerging market economies (EMEs) over 2005–2021, we study the domestic and cross-border implications of zombie firms. We document three main findings. First, the number of zombie firms in emerging Asia has increased significantly over the past 15 years, sustained by evergreening practices from weak banks. Second, zombie prevalence domestically depresses firm performance, crowds out healthy firms, and depresses inflation and GDP growth. Third, the macroeconomic effects of zombie firms extend across borders: exposure to zombie firms in Asian EMEs significantly reduces inflation and growth in advanced economies. These spillover effects operate mainly through global value chains (GVCs) and an intermediate goods import price channel, while cross-border bank linkages do not play any major role.

Keywords: zombie firms, evergreening, global value chains, cross-border spillovers, disinflation, financial stability

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†Bank for International Settlements. Email: boris.hofmann@bis.org

‡International Monetary Fund. Email: aliu2@imf.org

§Bank for International Settlements. Email: ilhyock.shim@bis.org

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1 Introduction

Zombie firms—insolvent firms that keep operating—have attracted growing attention as a source of resource misallocation, depressed productivity, and muted economic dynamism. A substantial body of research has documented the role of zombie firms in Japan (Peek and Rosengren, 2005; Caballero et al., 2008), Europe (Acharya et al., 2019; Schivardi et al., 2022; Blattner et al., 2023), and globally (McGowan et al., 2018; Banerjee and Hofmann, 2022; Albuquerque and Iyer, 2024). A rise in the prevalence of zombie firms has also been documented in emerging market economies (EMEs), in particular in emerging Asia (e.g. Tan et al. (2016), IMF (2026), Jeong (2018)), a region that accounts for more than half of global manufacturing output and sits at the heart of global value chains (GVCs). However, the extant studies focus on individual economies. A comprehensive analysis covering the entire region is still missing.

This paper aims to fill this gap by studying the prevalence, drivers and implications of zombie firms in 10 Asian emerging market economies (EMEs) over the period of 2005–2021. Our analysis makes two main contributions.

First, we extend the zombie firm literature to Asian EMEs—a region that is central to GVCs yet largely absent from the empirical zombie literature. We document a significant increase by more than 50%, accounting for 13% of firm assets and 20% of firm debt over the past 15 years across the 10 Asian EMEs. We further show that zombie firms are highly persistent, with a continuation rate of about 95% each year. The high persistence of zombie firms is, in turn, linked to evergreening practices of weakly capitalised banks. At the macroeconomic level, the rise in zombie firms has been associated with a significant dampening of growth and inflation in the region, by about 0.2 percentage points per year.

Second, we provide novel evidence for a global dimension of zombification operating through GVCs. We find that Asian EME zombie firms induce significant negative cross-border spillover effects on advanced economies' growth and inflation. We further provide evidence suggesting that these spillover effects operate through GVC linkages while cross-border bank links do not appear to play a major role. While previous evidence highlighted

that zombie firms depress economic dynamism and inflation domestically (Albuquerque and Iyer, 2024; Acharya et al., 2024), we show that the distortion travels internationally: a country can import lower growth and disinflation from another economy's zombie problem. According to our baseline dynamic estimates, the rise in zombie firms in emerging Asia has dampened both real growth and inflation in advanced economies by about 0.4 percentage points over medium run horizons.

The analysis is based on granular firm- and bank-level data for 10 Asian EMEs, data on trade and cross-border bank links and macroeconomic data. It proceeds in four steps. In Section 3, we document the prevalence and persistence of zombie firms in Asian EMEs. We also establish *why* zombie firms persist: weak banks sustain them through evergreening, with an important asymmetry in lending behavior between domestic and foreign banks. In the next section, we trace the *domestic consequences*—depressed firm performance, crowding out of healthy firms, and lower inflation and GDP growth (Section 4). In Section 5, we examine whether these domestic distortions spill over internationally. Section 6 concludes.

Literature Review

Our paper contributes primarily to the literature on zombie firms and their drivers and implications.[1] The phenomenon of zombie firms, i.e. insolvent firms that do not exit markets through bankruptcy or takeover, was first observed in Japan, where it was highlighted as a potentially important reason for Japan's lost decade of the 1990s (Caballero et al. (2008)).[2] McGowan et al. (2018) document that the number of zombie firms has increased significantly across the advanced economies in the wake of the Great Financial Crisis (GFC), while Banerjee and Hofmann (2018) document a longer-lasting trend increase since the 1980s. For EMEs, evidence remains limited. Albuquerque and Iyer (2024) construct a global dataset spanning advanced economies and EMEs, finding that zombie prevalence has risen worldwide, but without going into regional differences. Tan et al. (2016) and IMF (2026) highlight the significance of zombie firms in China. Our

[1] See Acharya et al. (2022) for a more detailed recent survey

[2] For early studies on the emergence of zombie firms in Japan, see Peek and Rosengren (2005), Hoshi (2000) and Hoshi (2006).

paper extends this literature to 10 Asian EMEs with firm-bank linked data, a region that has received surprisingly little attention given its centrality in GVCs.

The literature has identified weak banks as a key factor behind the emergence of zombie firms. Caballero et al. (2008) find that the rise of zombie firms in Japan in the 1990s was linked to weakly capitalized banks which evergreened loans. Similarly, Andrews and Petroulakis (2019), Acharya et al. (2019) and Schivardi et al. (2022) highlight a link between weak banks and zombies in advanced economies.[3] Albuquerque and Mao (2025) identify a "zombie lending channel of monetary policy": when interest rates rise, evergreening motives strengthen because lenders face greater incentives to avoid loss recognition. One of our contributions is to document the bank–zombie nexus in Asian EMEs and, critically, to show the asymmetric behavior of domestic versus foreign banks—a distinction not explored in the existing literature. We also document the relevance of a zombie lending channel transmitting changes in interest rates.

A key economic consequence of zombie firms is reduced economic dynamism and performance. Specifically, zombie firms are found to be less productive and at the same time create congestion effects for other, more productive firms (Caballero et al. (2008), McGowan et al. (2018), Albuquerque and Iyer (2024)). Banerjee and Hofmann (2022) present evidence suggesting that the adverse effects of zombie firms are statistically and economically significant in aggregate productivity. Acharya et al. (2024) highlight excess supply exerting disinflationary pressures as an additional macroeconomic effect of zombie firms. Their estimates suggest that this channel may have lowered European inflation by 0.2 percentage points after 2012. We add to this literature by showing that zombie firms are less productive and adversely affect the performance of healthy firms. We further document that the effect of zombie firms is felt at the aggregate level, with higher degrees of zombification being associated with economically and statistically significant adverse effects on output growth and inflation.

Our analysis highlights the global implications of zombification in emerging Asia. We

[3]Recent conceptual contributions have highlighted, however, that evergreening of zombie loans may be linked to relationship lending and may arise independently from impaired bank health (Hu and Varas (2021), Blattner et al. (2024)).

find that the rise in zombie firms in the region had a strong negative effect on growth and inflation in advanced economies. We identify GVC linkages as the main channel at work in these spillover effects, while cross-border bank linkages do not play a major role. This result adds a new, global dimension to the literature on zombie firms. It links our paper to the literature on the global determinants of growth and inflation. Specifically, our paper bridges the zombie firm literature and the global inflation literature (Borio and Filardo (2007), Forbes (2019)) by identifying zombie prevalence as a concrete supply-side source of cross-border disinflation, and by conducting a direct comparison of the trade and bank lending channels. Our results connect in particular with previous findings highlighting the importance of GVCs in global inflation linkages (Auer et al. (2019), Auer and Mehrotra (2014), Chau et al. (2024)).

2 Data

Our sample covers 10 Asian EMEs: China, Chinese Taipei, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, and Thailand, over the period of 2005–2021. We draw on the following data sources:

- **Firm financials and firm-bank linkages:** The Oriana database of Bureau van Dijk, providing annual balance sheet and income statement data as well as information on each firm's main banks.
- **Bank financials:** SNL Financial, providing annual data on bank capital ratios (CET1, Tier 1), NPL ratios, ROA, liquid asset ratios, and loan-to-deposit ratios.
- **Macroeconomic data:** CPI, real GDP growth, unemployment rate, policy rates, and lending rates from the IMF International Financial Statistics database, which are also reported by the World Bank.[4]
- **Bilateral trade data:** UN Comtrade data, providing bilateral imports of *merchandise goods* by Standard International Trade Classification (SITC) product category. SITC codes are mapped into the Broad Economic Categories (BEC) by end-use—intermediate goods (industry inputs), capital goods (investment goods),

[4]These lending rates are a country's average interest rates on commercial banks' short- and medium-term loans to the private sector businesses and households, often adjusted by creditworthiness.

and consumer goods (final consumption goods). Services trade is not included; the BEC classification itself covers international merchandise trade only.

- **International banking data:** BIS Consolidated Banking Statistics (CBS), providing bilateral bank claims by the nationality of lending banks to emerging Asian counterparties.

All firm and bank financial variables are winsorized at the 1st and 99th percentiles. Appendix Table A1 reports coverage by economy: about 717,000 firms and 3.4 million firm-year observations with a computable interest coverage ratio over 2008–2020, and 326 banks (622 bank–country units) matched to SNL Financial data.

3 Zombie Firm Prevalence and Persistence

Following the literature (Banerjee and Hofmann, 2018; McGowan et al., 2018), we define zombie firms based on the interest coverage ratio (ICR). A firm is classified as a zombie in year t if its ICR (EBIT divided by interest expenses) has been below 1 for at least three consecutive years (t, $t-1$, $t-2$), with specific criteria for remaining as a zombie for firms that temporarily exit and re-enter the criterion.[5] Results are similar under a stricter definition that additionally requires sales growth below the SIC 2-digit industry–year median (available upon request).

3.1 Zombie Prevalence and Characteristics

Figure 1 plots the aggregate zombie firm share across the 10 Asian EMEs over 2008–2021. Measured by the number of firms, the zombie share rose from approximately 11% in 2008 to 17% by 2021; measured by total assets, the share increased from 6% to 13%, with a pronounced spike to 16% around 2015–2016; and measured by debt, the share roughly doubled from 9% in 2008 to 20% by 2021. This rise is consistent with patterns documented in advanced economies by Banerjee and Hofmann (2018).

[5] A firm enters zombie status when its ICR > 1 for three consecutive years. Once classified as a zombie, the firm retains zombie status as long as it continues to exhibit ICR < 1 in at least one of every two consecutive years, so brief one-year recoveries do not remove the zombie label. Zombie status is removed only after three consecutive years with ICR ≥ 1. This smoothing rule avoids spurious transitions due to one-time income fluctuations and ensures that genuinely recovered firms exit zombie status.

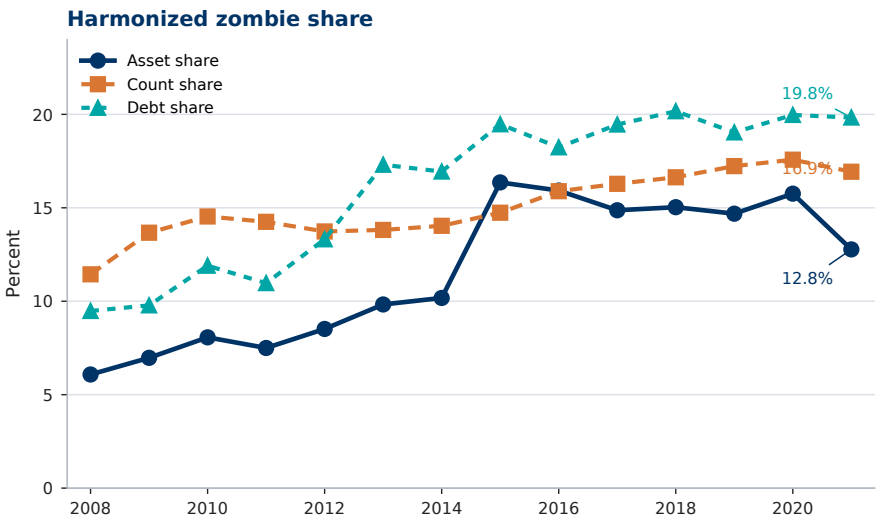

Figure 1: Zombie Firm Prevalence in Asian EMEs, 2008–2021

Notes: "Count share" is the share of the number of zombie firms in the total number of firms (%). "Asset share" is the share of zombie firms' total assets in all firms' total assets (%). "Debt share" is the share of zombie firms' total debt in all firms' total debt (%). Zombie: ICR < 1 for ≥ 3 consecutive years. Source: Oriana.

Figure 2 illustrates the zombie life cycle through transition probabilities. From 2011 onward, approximately 93–95% of zombie firms remain zombie from one year to the next, while only about 3% of healthy firms enter zombie status in any given year. This high persistence—and the sharp asymmetry between entry and exit rates—raises a natural question: what sustains these firms? We address this in the next section.

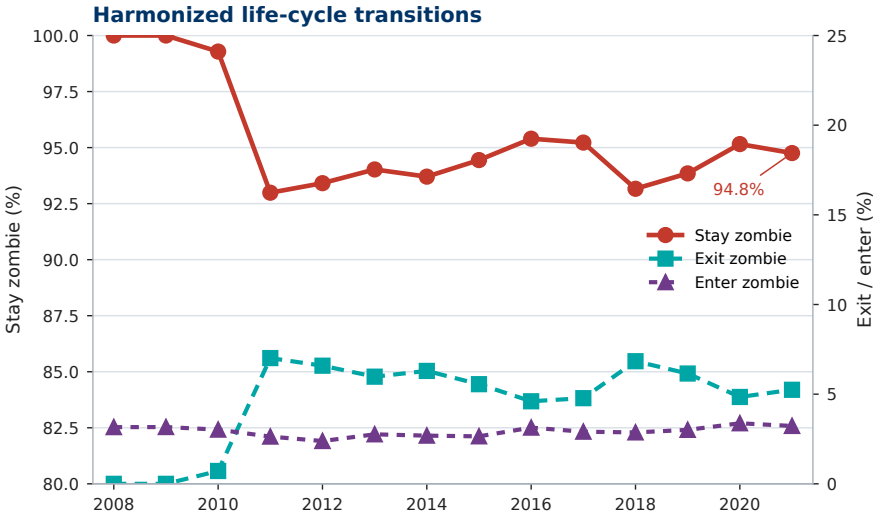

Figure 2: Zombie Firm Life Cycle: Transition Probabilities

Notes: "Stay zombie": prob. that a zombie in $t-1$ remains zombie in t. "Exit zombie": 1− "Stay zombie". "Enter zombie": prob. that a non-zombie in $t-1$ becomes zombie in t. "Stay normal": 1− "Enter zombie". Source: Oriana.

Table 1: Summary Statistics: Firm Characteristics and Bank Nexus

	Mean (Total)	Mean (Zombie)	Mean (Non-zombie)	Difference
Panel A: Firm Characteristics				
ROA (%)	3.773	−4.917	4.673	9.589***
Sales growth	0.354	0.391	0.350	−0.041***
Capex ratio	1.699	1.303	1.740	0.438***
Interest rate (%)	5.896	5.417	5.954	0.538***
Tobin's q	1.092	1.000	1.111	0.111***
Firm age (years)	13.793	17.173	13.439	−3.734***
ICR	38.090	−9.064	43.436	52.499***
Log(total assets) (m USD)	1.644	2.184	1.588	−0.596***
Employee growth	0.020	−0.037	0.028	0.065***
Debt growth	0.063	−0.022	0.073	0.095***
Leverage (Debt/TA)	0.335	0.507	0.317	−0.190***
Cash flow/TA	0.059	−0.023	0.067	0.090***
Tangible/TA	0.297	0.388	0.288	−0.100***
No. of observations	1,254,459	117,658	1,136,801	
Panel B: Bank Characteristics — average across all relationship banks (up to top 5) lending to each firm				
CET1 ratio (%)	10.89	10.83	10.90	0.07***
Tier 1 ratio (%)	11.56	11.57	11.56	−0.02
Bank total assets (m USD)	245,586	218,190	248,420	30,230***
Log(bank total assets) (m USD)	11.51	11.52	11.51	−0.01
NPL ratio (%)	4.50	5.15	4.43	−0.72***
Bank ROA (%)	0.71	0.59	0.73	0.14***
Liquid asset ratio (%)	29.42	26.96	29.69	2.74***
Loan-to-deposit ratio (%)	87.16	87.89	87.07	−0.82***
No. of banks	2.22	2.39	2.20	−0.19***
Loans-to-zombies share (%)	15.55	20.22	15.02	−5.20***
Share of foreign banks	0.11	0.09	0.11	0.02***

Notes: Panel A reports means of firm-level variables for all firms, zombie firms, and non-zombie firms, with t-tests for differences. Zombie firms are identified using the ICR criterion (ICR < 1 for at least three consecutive years). ROA is computed as net income divided by total assets, and is distinct from the cash-flow proxy EBITDA/Total Assets ("internal funding") used in the capex regression of Table 5. The interest rate for each firm is calculated as the ratio of the average amount of interest paid to the average amount of total debt. Panel B reports bank-level statistics averaged across each firm's relationship banks (up to top 5). Because the average number of relationship banks per firm in our sample is between 2.2 and 2.4, the panel reflects an average across the firm's full set of disclosed lenders, not always five. Sources: Oriana (Bureau van Dijk) and SNL Financial. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 1 presents summary statistics for firms and their associated banks. Panel A compares firm-level financials between zombie and non-zombie firms. Zombie firms have significantly lower ROA (−4.9% vs. 4.7%), higher leverage (0.51 vs. 0.32), lower investment ratios (1.3 vs. 1.7), and slower employment growth (−0.04 vs. 0.03). Notably, zombie firms are *older* (17.2 vs. 13.4 years) and pay *lower* interest rates (5.4% vs. 6.0%), consistent with the definitions based on subsidized interest rates used in Caballero et al. (2008). All differences are statistically significant at the 1% level. Panel B reports the average bank-level financials for banks lending to zombie and non-zombie firms. Zombie firms are connected to banks with higher NPL ratios (5.15% vs. 4.43%) and lower ROA (0.59% vs. 0.73%), and banks lending to zombie firms have on average a higher share of loans to zombies than those lending to non-zombie firms (20.2% vs. 15.0%). Foreign banks account for a smaller share of zombie firms' banking relationships (9% vs. 11%), foreshadowing the domestic–foreign asymmetry that features prominently in our analysis.

3.2 The Bank–Zombie Nexus: Why Zombies Persist

The high persistence of zombie status documented above suggests that external forces—beyond firm fundamentals—sustain distressed firms. There are basically only two ways for a zombie firm to stay zombie and avoid default. The first is banks' evergreening, that is, either lending more to zombies (to cover interest payments while not requiring zombies to repay the principal) or not requiring firms to pay anything at least temporarily (loan restructuring). The second is for a zombie firm to use its existing cash holdings, or sell some of its assets to obtain cash and use the cash to pay back loan interest or principal. The second channel is unlikely to be sustainable for an extended period of time. In this section, we present evidence that banks' evergreening of loans to zombie firms is a key mechanism.[6] We first establish that zombie lending is persistent and amplified

[6]A natural alternative is that zombie firms are sustained not by banks but by non-bank financial institutions or non-financial corporates. We cannot genuinely observe firms' off-balance sheet borrowing in the Oriana database, but we can examine on-balance-sheet non-bank borrowing under the assumption that most financial debt (i.e. current liabilities excluding trade payables and account payables) is bank-sourced while the remaining liabilities—trade payables, account payables, and non-current liabilities—are sourced from non-bank entities. Within country×year and sector×year fixed effects, zombie firms hold a 13.8 percentage point *lower* share of non-bank liabilities (and a 9.0 percentage point lower trade-credit share) than comparable non-zombie firms; that is, their liabilities are more concentrated in bank debt. Far from escaping into non-bank funding, zombies are, if anything, more bank-dependent, so the

by weak bank health, and then show that it differs systematically between domestic and foreign banks—a distinction that will prove central to understanding why the bank lending channel does not transmit zombie risk internationally.

3.3 Zombie Lending and Bank Health

Bank-level zombie lending share. For each bank j in country c at time t, we compute $\text{LoanToZombie}_{j,c,t}$: the estimated share of the bank's loans directed to zombie firms, based on firm-bank linkage information and assumed lending proportions reflecting the importance/ranking of each bank to each firm as a main bank.[7]

We estimate:

$$\begin{aligned}\text{LoanToZombie}_{j,c,t} = \alpha \cdot \text{LoanToZombie}_{j,c,t-1} + \beta \cdot (L_{j,c,t-1} \times \text{LoanToZombie}_{j,c,t-1}) \\ + Z'_{j,c,t-1}\gamma + \mu_{j,c} + \tau_t + \varepsilon_{j,c,t}\end{aligned} \tag{1}$$

where L represents a bank health indicator (a high-NPL dummy taking the value one if the NPL ratio is above the cross-bank median and zero otherwise, or the Tier 1 capital ratio), Z includes bank controls (NPL ratio or high-NPL dummy, Tier 1 ratio, liquid asset ratio, loan-to-deposit ratio, ROA), and $\mu_{j,c}$ and τ_t are bank–country and year fixed effects, respectively.

In column (1) of Table 2, the coefficient on the lagged zombie lending share is 0.57 ($p < 0.01$), confirming strong persistence. Column (2) shows that persistence is amplified by weak asset quality: the coefficient on the interaction term of the share and the high-NPL dummy is 0.085 ($p < 0.01$), consistent with loss-avoidance motives.[8] Column (3) uses the Tier 1 ratio instead: the coefficient on the interaction terms of the Tier 1 ratio and the zombie lending share is -0.020 ($p < 0.01$), so persistence is stronger for less

bank-evergreening channel we document is, if anything, understated.

[7]When a firm has n main banks, we assign lending shares as follows: 2 banks: 60%/40%; 3 banks: 50%/30%/20%; 4 banks: 45%/25%/20%/10%; and 5 banks: 45%/25%/10%/10%/10%. We also assign different shares for the 2-, 3-, 4- and 5-bank cases and the results are qualitatively same. For the firm-level analyses in Tables 3 and 4, the relationship-bank averages are reported using an equal-weighted top-5 mean for simplicity. We verify that constructing a firm-level $\text{LoanToZombie}_{i,c,t}$ as the bank-rank-weighted sum across each firm's top-5 banks (using the weighting scheme above) yields virtually identical coefficients in Table 4: the coefficients on the LoanToZombie (LTZ) variable and on the Tier 1×LTZ and NPL×LTZ interaction terms retain their sign, magnitude, and statistical significance.

[8]The dummy (NPL ratio above the cross-bank median) captures non-linearity; the continuous NPL ratio in column (1) is insignificant. Results with continuous interaction terms are in Appendix Table A2.

Table 2: Persistence of Zombie Lending and Bank Health

Bank-health interaction	(1) None	(2) High NPL	(3) Tier 1	(4) Both
Lagged LoanToZombie	0.574***	0.539***	0.852***	0.833***
	(0.010)	(0.013)	(0.035)	(0.035)
Lagged LoanToZombie × High NPL		0.085***		0.106***
		(0.019)		(0.019)
Lagged LoanToZombie × Tier 1 ratio			−0.020***	−0.022***
			(0.002)	(0.002)
High NPL		0.182		−0.044
		(0.534)		(0.531)
NPL ratio	0.022		0.002	
	(0.132)		(0.131)	
Tier 1 ratio	−0.063	−0.070	0.075	0.078
	(0.080)	(0.080)	(0.082)	(0.081)
Liquid asset ratio	0.003	0.002	−0.001	−0.002
	(0.021)	(0.021)	(0.021)	(0.021)
Loan-to-deposit ratio	0.007	0.007	0.009	0.009
	(0.014)	(0.014)	(0.014)	(0.014)
Bank ROA	0.368	0.418	0.297	0.344
	(0.432)	(0.413)	(0.430)	(0.411)
Observations	6,406	6,406	6,406	6,406
R^2	0.606	0.608	0.610	0.613
Joint p(High NPL×LTZ = Tier 1×LTZ = 0)				<0.001
Bank–country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: The dependent variable is the share of a bank's loans to zombie firms in loans to all firms (LoanToZombie, LTZ) in a country of a bank in a year (in %). High NPL equals one if a bank's NPL ratio exceeds the cross-bank annual median. Column 1 is the baseline persistence test; column 2 adds High NPL and its interaction with lagged LoanToZombie; column 3 instead interacts lagged LoanToZombie with the (continuous) Tier 1 capital ratio; column 4 includes both interactions. All regressions include bank–country and year fixed effects. All explanatory variables are lagged one period. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

well-capitalized banks (0.62 at the sample-mean Tier 1 ratio of 11.6%, rising by 0.02 per percentage point less capital). Both interactions survive jointly in column (4) ($p < 0.001$): capital and asset quality are independent drivers of zombie lending.

Appendix Table A3 splits columns (1)–(2) by foreign and domestic banks and reveals an asymmetry that matters for Section 5: foreign banks display *higher* persistence (0.59 vs. 0.41), and the high-NPL interaction is positive for foreign but negative for domestic banks. Foreign banks, for whom Asian exposures are a small share of the portfolio, appear to "maintain and monitor" rather than withdraw—without balance sheet deterioration, as Section 5.6 shows—whereas domestic banks with high NPL ratios cut zombie lending, plausibly under supervisory pressure.

If evergreening is operative, zombie firms' borrowing should be insensitive to adverse shocks to their banks' health, while non-zombie firms' borrowing should contract. We test this by estimating separate regressions for firms that are classified as zombies in *all* years ("always-zombie") and for firms that are *never* classified as zombies ("never-zombie"). This sharper split mitigates concerns related to temporary financial distress and transitional dynamics, providing a cleaner test of banks' evergreening incentives.

The dependent variables are the log of total debt, leverage (debt/total assets), and debt growth (percentage change).[9] The key explanatory variables are bank health indicators (NPL ratio, Tier 1 ratio, liquid asset ratio) and the country-level lending rate. The regressions include firm-level controls, firm fixed effects, and industry–year fixed effects.

Table 3 reveals a sharp contrast. For never-zombie firms, weaker bank health, measured by the NPL ratio, is associated with significantly lower borrowing: a one-percentage-point increase in the bank NPL ratio is associated with lower log debt (-0.016, $p < 0.05$), lower leverage (-0.004, $p < 0.01$), and lower debt growth (-0.015, $p < 0.01$). For always-zombie firms, the NPL coefficient is *positive* and significant for log debt (0.067, $p < 0.05$) and leverage (0.025, $p < 0.05$), and insignificant for debt growth. This pattern indicates that banks reduce credit to normal (i.e., never-zombie) firms and continue to roll over credit to chronically distressed (i.e., always-zombie) borrowers precisely when their own

[9]Results for net new borrowing (ΔDebt, in US dollars) are similar to those for debt growth and available upon request.

balance sheets weaken—direct evidence of evergreening. These results imply that, when banks' health deteriorates, their credit supply continues to flow to unproductive (i.e., always-zombie) firms, while they reduce credit to productive (i.e., never-zombie) firms.

Two caveats are in order. First, the point estimates speak to the per-firm credit response, not to aggregate dollar flows. The never-zombie group is roughly ten times more numerous than the always-zombie group in our estimation sample (Table 3: $N = 19{,}391$ vs. $N = 1{,}899$ in the log-debt columns), and the two groups carry debt balances of broadly comparable order of magnitude, so the aggregate dollar flow reallocated when bank health deteriorates is roughly symmetric across the two groups; the asymmetry is in the sign of the per-firm response, not in headline volumes. Second, the coefficient on the Tier 1 ratio is insignificant in all three pairs of columns. This is consistent with the pooled result in Table 2 and reflects the fact that banks in our sample are generally well capitalized (the mean Tier 1 ratio is 11.6%, well above the Basel III's 6% minimum; Table 1), so small variations in the Tier 1 ratio within that range do not have binding impacts on banks' lending decisions. The active margin is the NPL ratio.[10]

3.4 Evergreening and Bank Relationships

If banks sustain zombie firms through evergreening, a stronger bank–zombie nexus should delay firms' recovery or exit. We measure the bank–firm nexus in two complementary ways. The first is $\text{LoanToZombie}_{i,t-1}$, constructed as the average of the top-5 relationship banks' share of loans to zombie firms (see Section 2). We then estimate, for columns (1)–(3) of Table 4:

$$\begin{aligned}\text{StayZombie}_{i,t} = \beta_1 \cdot \text{LoanToZombie}_{i,t-1} + \beta_2 \cdot (X_{i,t-1} \times \text{LoanToZombie}_{i,t-1}) \\ + W'_{i,t-1}\gamma + \mu_i + \tau_{c,t} + \tau_{s,t} + \varepsilon_{i,t}\end{aligned} \tag{2}$$

[10] Appendix Table A4 presents results for the broader zombie vs. non-zombie split, which show the same directional pattern but with less statistical power, as expected given the inclusion of firms that transition between the two states. Appendix Table A5 provides complementary evidence that zombie firms are significantly more likely to experience years with minimal debt adjustments (absolute debt growth below 5% or 10%), consistent with banks rolling over existing exposures.

Table 3: Credit Sensitivity to Bank Health: Always-Zombie vs. Never-Zombie Firms

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable	Log(debt)		Leverage		Debt growth	
Sample	Always zombie	Never zombie	Always zombie	Never zombie	Always zombie	Never zombie
Tier 1 ratio	−0.026	−0.000	0.006	0.001	0.002	0.007
	(0.043)	(0.010)	(0.009)	(0.000)	(0.028)	(0.006)
Liquid asset ratio	−0.000	−0.008**	0.001	−0.001*	0.014	−0.000
	(0.012)	(0.003)	(0.003)	(0.000)	(0.010)	(0.002)
NPL ratio	0.067**	−0.016**	0.025**	−0.004***	−0.014	−0.015***
	(0.029)	(0.007)	(0.012)	(0.001)	(0.015)	(0.004)
Lending rate	0.116	0.109***	−0.007	0.012***	0.049	−0.003
	(0.130)	(0.022)	(0.024)	(0.002)	(0.072)	(0.012)
Log size	0.638***	0.964***	−0.009	0.032***	−0.155***	−0.218***
	(0.097)	(0.049)	(0.021)	(0.006)	(0.059)	(0.022)
Sales growth	0.033	0.006	0.014**	−0.001	0.007	0.001
	(0.033)	(0.015)	(0.006)	(0.002)	(0.026)	(0.011)
Tangible assets	1.118***	1.223***	0.137	0.096***	−0.189	−0.410***
	(0.400)	(0.169)	(0.083)	(0.019)	(0.247)	(0.086)
Observations	1,899	19,391	2,065	21,413	1,991	19,992
R^2	0.882	0.891	0.751	0.772	0.303	0.177
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: "Always zombie" firms are classified as zombies in all observed years; "never zombie" firms are never classified as zombies. The dependent variables are log total debt, leverage (debt/TA), and debt growth. Bank health indicators are averaged across each firm's top-5 relationship banks (pooling across domestic, foreign, and mixed relationships) and lagged one year. The lending rate is measured contemporaneously at the country level. Firm-level controls are lagged one year. The liquid asset ratio is statistically significant only in column (2); we do not interpret this single coefficient in the body of the paper. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

where the sample is restricted to firms classified as zombies in year $t-1$; $\text{StayZombie}_{i,t}$ equals one if firm i remains a zombie in year t; $X_{i,t-1}$ is the firm's top-5 relationship-bank average Tier 1 ratio (columns (1) and (3)) or a high-NPL dummy equal to one if the relationship-bank average NPL ratio exceeds the country–year median (columns (2) and (3)); $W_{i,t-1}$ is a vector of firm-level relationship-bank financial controls (NPL ratio, Tier 1 ratio, liquid asset ratio, ROA), each constructed as the same top-5 bank average for each firm; and μ_i, $\tau_{c,t}$, $\tau_{s,t}$ are firm, country–year, and industry–year fixed effects, respectively. With this notation, both the LoanToZombie nexus and the term interacted with a bank-health indicator $X_{i,t-1}$ are aggregated to the firm level across the firm's relationship banks, so that the regression speaks directly to the firm's overall exposure to weak, zombie-lending banks rather than to any single bank.

The second nexus measure is the firm's total *number* of relationship banks, NoofBank_i, used in columns (4)–(7) of Table 4. Because NoofBank_i is time-invariant for each firm, the level effect is identified without firm fixed effects as shown in equation (6). However, the bank-health interaction term in columns (5)–(7) varies over time through $X_{i,t-1}$, which allows firm fixed effects to be reinstated:

$$\text{StayZombie}_{i,t} = \beta_3 \cdot \text{NoofBank}_i + W'_{i,t-1}\gamma + \tau_{c,t} + \tau_{s,t} + \varepsilon_{i,t} \tag{3}$$

$$\text{StayZombie}_{i,t} = \beta_4 \cdot \text{NoofBank}_i + \beta_5 \cdot (X_{i,t-1} \times \text{NoofBank}_i) + W'_{i,t-1}\gamma + \mu_i + \tau_{c,t} + \tau_{s,t} + \varepsilon_{i,t}. \tag{4}$$

Columns (1)–(3) of Table 4 interact the relationship-bank LoanToZombie share with the two bank-health measures of Table 2. The coefficient on lagged LoanToZombie is positive and significant throughout: zombie firms connected to banks with higher zombie-lending exposure are more likely to remain zombies. The Tier 1 interaction is negative and significant (-0.0006, $p < 0.05$), so the lock-in effect is stronger when a firm's banks are less well capitalized, consistent with Table 2. The high-NPL interaction is zero, alone and in the horse race. At the firm level, therefore, it is bank capital rather than asset quality that amplifies the lock-in effect.[11]

[11] With the continuous NPL ratio, the interaction is -0.0006 ($p < 0.10$) but not robust. One reason is that the bank-level NPL effect differs in sign between foreign and domestic banks (Appendix Table A3),

Table 4: Zombie Persistence and the Bank–Firm Nexus

DV: StayZombie dummy	LoanToZombie nexus			NoofBank nexus			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bank-health interaction term	Tier 1	High NPL	Both	None	Tier 1	High NPL	Both
Lagged LoanToZombie	0.0104***	0.0021**	0.0102***				
	(0.0037)	(0.0011)	(0.0037)				
Tier 1 ratio × LoanToZombie	−0.0006**		−0.0006**				
	(0.0003)		(0.0003)				
High NPL × LoanToZombie		0.0004	0.0005				
		(0.0012)	(0.0012)				
NoofBank				0.0078***			
				(0.0019)			
Tier 1 ratio × NoofBank					−0.0029*		−0.0028*
					(0.0017)		(0.0017)
High NPL × NoofBank						0.0038	0.0035
						(0.0041)	(0.0041)
High NPL		0.0047	0.0035			−0.0053	−0.0058
		(0.0204)	(0.0204)			(0.0210)	(0.0210)
NPL ratio	−0.0058	−0.0033	−0.0070	0.0004	−0.0013	−0.0024	−0.0020
	(0.0051)	(0.0052)	(0.0054)	(0.0029)	(0.0048)	(0.0049)	(0.0049)
Tier 1 ratio	−0.0015	−0.0102*	−0.0019	0.0059*	−0.0032	−0.0096	−0.0033
	(0.0071)	(0.0062)	(0.0072)	(0.0035)	(0.0072)	(0.0062)	(0.0072)
Liquid asset ratio	−0.0049**	−0.0046**	−0.0048**	0.0006	−0.0045**	−0.0044**	−0.0045**
	(0.0020)	(0.0020)	(0.0020)	(0.0007)	(0.0020)	(0.0020)	(0.0020)
Log size	0.0241**	0.0243**	0.0239**	0.0092**	0.0260**	0.0252**	0.0259**
	(0.0113)	(0.0113)	(0.0113)	(0.0040)	(0.0112)	(0.0112)	(0.0112)
Sales growth	0.0032	0.0033	0.0032	0.0017	0.0036	0.0037	0.0036
	(0.0048)	(0.0048)	(0.0048)	(0.0052)	(0.0048)	(0.0048)	(0.0048)
ROA	−0.0036***	−0.0036***	−0.0036***	−0.0067***	−0.0037***	−0.0037***	−0.0037***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Observations	6,284	6,284	6,284	6,486	6,287	6,287	6,287
R^2	0.725	0.724	0.725	0.409	0.724	0.724	0.724
Joint p(both interactions = 0)			0.074				0.163
Firm FE	Yes	Yes	Yes	No	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Sample restricted to firms classified as zombies in $t-1$. The dependent variable equals one if the firm remains a zombie in year t. The bank–firm nexus is proxied by the firm-level (top-5 average) loans-to-zombie share (columns 1–3) or the number of bank relationships, NoofBank (columns 4–7). High NPL equals one if the relationship-bank average NPL ratio exceeds the country–year median (cf. Table 2). Columns 3 and 7 include both interactions. NoofBank is time-invariant: its level is identified without firm fixed effects (column 4, equation (3)) and absorbed by them in columns 5–7 (equation (4)). All explanatory variables are lagged one period. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Columns (4)–(7) use the number of bank relationships. Zombie firms with more banks are more likely to remain zombies (0.0078, $p < 0.01$, column (4)), consistent with a coordination failure among creditors. The Tier 1 interaction is negative and marginally significant (−0.0029, $p < 0.10$), while the high-NPL interaction is again insignificant: the coordination failure, too, is aggravated by weak bank capital.

4 Domestic Macroeconomic Consequences

Having established the prevalence and persistence of zombie firms, we now trace the real economy consequences of zombie prevalence within Asian EMEs. We proceed from the

and the firm-level top-5 bank average pools both.

firm level to the sector level and to the country level.

4.1 Firm-Level Effects

The literature suggests that one way through which zombie firms weigh on overall economic performance is by their own weak economic dynamism. To assess this point, we test how much zombie status is reflected in weak economic dynamism of a firm. To this end, we estimate:

$$Y_{i,t} = \beta \cdot \text{Zombie}_{i,t} + X'_{i,t-1}\delta + \mu_i + \tau_{c,t} + \varepsilon_{i,t} \tag{5}$$

where $Y_{i,t}$ is ROA, sales growth, the capex ratio, or employee growth, $\text{Zombie}_{i,t}$ is a dummy variable indicating if a firm categorised as a zombie firm or not, and $X_{i,t-1}$ is a vector of lagged firm controls (leverage, log size, tangible assets, capex ratio; for the capex and employment outcomes, the capex-ratio control is replaced by the outcome-specific cash-flow control described in the notes to Table 5), μ_i are firm fixed effects, and $\tau_{c,t}$ are country–year fixed effects. Standard errors are clustered at the firm level.

Table 5 shows that zombie firms have lower ROA (-2.77 percentage points) and sales growth (-5 percentage points) than non-zombie firms (both $p < 0.01$); the conditional ROA gap is smaller than the unconditional gap of -9.59 percentage points in Table 1. Columns (3) and (4) extend the same specification to real-side outcomes: zombie firms also exhibit a significantly lower capex ratio (about 1 percentage point) and lower employment growth (about 3 percentage points) than non-zombie firms, so the weakness in profitability and sales is mirrored in investment and hiring. Results are robust to excluding persistent zombies (firms that are zombies in all sample years and are therefore equivalent to always-zombie firms), to restricting the sample to first-time transitions into zombie status, and to a post-2013 subsample where the effects are larger in magnitude. Further, a control-function instrumental variables (IV) approach using the country-level lending rate as an instrument yields a causal effect of approximately -2.5 percentage points on ROA, consistent with the OLS estimates.[12]

[12] Appendix Table A6 reports the full set of robustness checks: excluding persistent zombies, transition-window event studies ($[-1, 0]$, $[-1, 1]$, $[-1, 2]$), the pre-/post-2013 subsample split, and the control-function IV estimation. Beyond the firm-level employment-growth gap in column (4) of Table 5, zombie firms also tie up a non-trivial share of the workforce: the aggregate employment share in the 10 Asian

Table 5: Zombie Status, Firm Performance, and Real Effects

	(1) ROA (%)	(2) Sales growth	(3) Capex ratio	(4) Employee growth
Zombie dummy	−2.766***	−0.051***	−0.012***	−0.032***
	(0.073)	(0.010)	(0.001)	(0.003)
Leverage	2.145***	0.239***	−0.010***	−0.005
	(0.164)	(0.019)	(0.001)	(0.007)
Log size	−3.087***	−0.448***	−0.037***	−0.054***
	(0.058)	(0.011)	(0.001)	(0.003)
Tangible asset	−1.217***	0.091***	−0.357***	0.026***
	(0.144)	(0.023)	(0.002)	(0.008)
Capex ratio	−0.003*	0.004***		
	(0.002)	(0.000)		
Sales growth	0.260***		0.0002**	0.005***
	(0.010)		(0.0001)	(0.001)
ROA (%)		−0.015***		0.001***
		(0.000)		(0.000)
Internal funding (EBITDA/TA)			0.028***	
			(0.002)	
Observations	992,703	943,720	897,176	329,784
R^2	0.511	0.301	0.422	0.233
Firm FE	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes

Notes: The dependent variables are ROA (%, column 1), sales growth (column 2), the capital expenditure-to-total assets ratio (column 3), and employee growth (column 4). Zombie status follows the baseline ICR definition of Section 3. The zombie dummy is measured contemporaneously; all other explanatory variables are lagged one year. In columns (3)–(4) the cash-flow control follows the outcome: internal funding (EBITDA/Total Assets) for the capex ratio, since investment is constrained by pre-debt-service cash flow, and ROA (Net Income/Total Assets) for employee growth, since hiring decisions reflect bottom-line profitability after capital costs. The zombie coefficients are virtually unchanged when both cash-flow controls are entered jointly. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Beyond profitability and sales growth, zombie firms become markedly less *productive*—a fact central to interpreting the cross-border results in Section 5. Using the within-firm specification of Table 5 (firm and country×year fixed effects with the same lagged controls), a firm's transition into zombie status lowers its own labour productivity (log sales per employee) by about 8.5% and its value-added productivity (log value added per employee) by about 14% (Table A7). Zombie firms are therefore not efficient low-cost producers but facing deteriorating productivity and kept alive by evergreening, so their low-cost pricing reflects distorted excess capacity rather than genuine productivity gains.

An apparent tension in the conditional and unconditional estimates of sales growth of zombie vs. non-zombie firms merits discussion. While the *conditional* estimate in Table 5 shows that zombie firms have lower sales growth than non-zombie firms after controlling for firm characteristics, the *unconditional* comparison in Table 1 reveals the opposite: zombie firms actually exhibit slightly *higher* average sales growth than non-zombie firms (0.39 vs. 0.35). The conditional comparison is the economically meaningful one: once we hold leverage, size, and other firm characteristics fixed, zombie firms sell less per unit of assets than otherwise comparable non-zombie firms. Direct evidence for this comes from asset turnover (sales/total assets, distinct from capital turnover, which uses capital employed in the denominator) in Appendix Table A8: zombie firms exhibit significantly lower sales-to-total assets ratios (-0.039, $p < 0.01$), i.e. lower revenue for each dollar of assets, or equivalently lower asset turnover. We refer to this throughout the paper as zombie firms operating at lower asset turnover and lower markups than viable competitors. Direct evidence on the markup itself confirms this: after considering within-firm fixed effects (and the controls in Table 5), zombie firms post significantly lower gross and value-added margins (about 2 percentage points each), a lower operating margin (6.9 percentage points), and a compressed production-approach markup à la De Loecker and Warzynski (2012) (-2.4%), all $p < 0.01$; Appendix Table A9 reports these

EMEs rose to about 6–9% in 2015–2020, peaking near 8.6% in 2017. Roughly 2.5–3.2 million workers in the firms reporting employment were at zombie firms in the 10 Asian EMEs in 2016–2017. This employment share nonetheless sits *below* their asset share (11–13%), so zombies are more capital-intensive than labor-intensive—tying up proportionally more capital than labour—while still locking in a meaningful amount of employment, which speaks to the social stakes of zombie prevalence.

within-firm estimates.[13]

These observations clarify the volume-over-margin discussion. Zombie firms do not, on their own, generate positive profits by undercutting prices—by construction, their interest coverage ratio is below one, so any volume-over-margin strategy yields losses on EBIT before debt service. What sustains the strategy is the favorable cost of debt these firms enjoy: in our sample, zombie firms pay an average interest rate of 5.4% versus 6.0% for non-zombie firms (Table 1), a roughly 60 basis point gap that, given zombies' higher leverage, materially relaxes their cash-flow constraint. We refer to this gap as the *below-market borrowing cost* enjoyed by zombie firms, distinguishing it from generic "subsidized financing": the 60 basis point gap is not a fiscal subsidy but the equilibrium price at which weak banks evergreen loans to non-viable borrowers in order to avoid loss recognition (Section 3.2).

Two separate claims follow. First, zombie firms operate at lower markups than viable competitors; this is the supply-side excess-capacity mechanism through which they depress prices domestically and, as we show in Section 5, in advanced economies that import from them. Second, this pattern is sustainable over time only because zombies face below-market borrowing costs supplied by their relationship banks; absent that wedge, the volume-over-margin strategy would simply deepen losses and force exit. Disentangling the two clarifies that our cross-border disinflation result is driven by the markup channel, while the bank–zombie nexus documented in Section 3.2 is what allows that channel to remain active.

4.2 Contagion Effects

Zombie firms may harm the broader economy not only through their own underperformance but also by crowding out healthy firms. We test this by estimating equation (5) with the lagged country–sector zombie share (by total assets) as the key explanatory variable, restricting the sample to non-zombie firms.

[13]Under the stricter ICR-plus-below-median-sales-growth definition, the gaps are similar or larger—gross margin -1.6, value-added -2.8, and operating margin -11.4 percentage points, and the De Loecker–Warzynski markup -2.5%, all $p < 0.01$. The operating margin is partly mechanical because EBIT enters the ICR-based zombie definition, so the gross and value-added margins are the cleaner underpricing proxies.

Table 6: Contagion Effects: Zombie Prevalence and Non-Zombie Firm Performance

Sample	(1) ROA (%)	(2) Sales growth	(3) ROA (%)	(4) Sales growth
	Non-zombie in $t-1$		Never zombie	
Zombie share in TA (country–sector)	−1.072***	−0.168***	−0.757***	−0.107***
	(0.290)	(0.039)	(0.294)	(0.039)
Leverage	1.723***	0.330***	2.802***	0.383***
	(0.167)	(0.021)	(0.180)	(0.023)
Log size	−2.961***	−0.506***	−3.332***	−0.518***
	(0.058)	(0.013)	(0.063)	(0.013)
Tangible asset	−1.141***	0.114***	−0.896***	0.128***
	(0.153)	(0.023)	(0.155)	(0.023)
Capex ratio	−0.341***	0.004***	−0.758***	0.003***
	(0.109)	(0.000)	(0.109)	(0.000)
Sales growth	0.270***		0.267***	
	(0.010)		(0.011)	
ROA		−0.016***		−0.019***
		(0.000)		(0.000)
Observations	881,798	837,110	712,035	676,177
R^2	0.505	0.326	0.451	0.308
Firm FE	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes
Sector×Year FE	Yes	Yes	Yes	Yes

Notes: Columns 1–2 restrict the sample to firms that were non-zombies in $t-1$; columns 3–4 further restrict to firms that were never zombies in any year. The key regressor is the lagged country–sector zombie share in terms of total assets (ICR definition). All explanatory variables are lagged one period. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6 shows that a higher country–sector zombie share is associated with significantly lower performance among non-zombie firms. Since the zombie share is measured as a proportion (0 to 1), the coefficient of -1.07 ($p < 0.01$) on ROA implies that moving from zero to full zombification in a sector would lower non-zombie ROA by 1.07 percentage points; equivalently, a 10 percentage point increase in the sectoral zombie share lowers non-zombie ROA by approximately 0.11 percentage points. The effect on sales growth is -0.17 ($p < 0.01$). Results hold when further restricting the sample to firms that have *never* been zombies in any year (-0.76 for ROA, and -0.11 for sales growth, both $p < 0.01$). These findings are consistent with the crowding-out effects documented in Caballero et al. (2008) and McGowan et al. (2018): zombie firms in a sector absorb credit, labor, and the market share that would otherwise flow to more productive firms, harming healthy firms and depressing performance across the sector.

4.3 Macro Effects

The firm-level evidence establishes that zombie firms underperform (lower ROA and sales growth than healthy firms) and that their presence crowds out healthy firms within the same sector. These micro-level distortions should aggregate to the macro level through two channels. First, depressed profitability and weaker sales growth—both for zombie firms themselves and for non-zombie firms in zombie-congested sectors—imply lower aggregate output growth. Second, the excess production capacity sustained by zombie firms, combined with their need to generate cash flow to service debt, puts downward pressure on product prices, dampening inflation. We test these macro-level predictions directly by estimating country-level regressions:

$$\text{Inflation}_{c,t} = \beta_1 \cdot \text{ZombieShare}_{c,t-1} + X'_{c,t-1}\gamma + \mu_c + \tau_t + \varepsilon_{c,t} \tag{6}$$

$$\text{GDP\_Growth}_{c,t} = \beta_2 \cdot \text{ZombieShare}_{c,t-1} + Z'_{c,t-1}\delta + \mu_c + \tau_t + \varepsilon_{c,t} \tag{7}$$

Table 7 shows that a 1 percentage point increase in the lagged zombie share as a proportion of total assets is associated with significantly lower CPI inflation (-0.04 percentage points, $p < 0.05$) and lower real GDP growth (-0.04 percentage points, $p < 0.05$). Given that the zombie share rose by roughly 5–10 percentage points across several Asian economies after 2013, the implied cumulative effect is economically meaningful. The disinflationary effect is consistent with Acharya et al. (2024): zombie firms generate excess production capacity that puts downward pressure on product prices. The GDP growth effect reflects the productivity drag from resource misallocation at the firm and sector level in sections 4.1–4.2. It is quantitatively very similar to the effect on inflation (-0.04 percentage points lower growth for each percentage point increase in the zombie share).

5 Cross-Border Spillovers to Advanced Economies

The results of the previous section raise a natural question: if zombie firms dampen productivity and create disinflationary excess supply within Asian EMEs—driven by the volume-over-margin strategy that sustains their high unconditional sales growth at the

Table 7: Macroeconomic Effects of Zombie Prevalence

	(1)	(2)	(3)	(4)	(5)	(6)
	Inflation			Real GDP growth		
Zombie share in TA (ICR)	−0.037**	−0.035**	−0.031*	−0.044**	−0.036	−0.033
	(0.017)	(0.015)	(0.015)	(0.021)	(0.031)	(0.032)
Unemployment rate		−0.359**	−0.220			
		(0.172)	(0.180)			
Commodity price change		0.031	0.018			
		(0.047)	(0.047)			
Inflation			0.249**			
			(0.108)			
GFCF/GDP					−0.029	−0.009
					(0.105)	(0.111)
Credit-to-GDP					0.009	0.008
					(0.012)	(0.012)
Population growth					0.529	0.509
					(0.611)	(0.614)
Real GDP growth						−0.069
						(0.119)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	108	99	97	124	99	99
R^2	0.749	0.760	0.773	0.763	0.818	0.819

Notes: The dependent variables are annual CPI inflation (columns 1–3) and real GDP growth (columns 4–6) in Asian EMEs. The key regressor is the lagged asset-weighted zombie share (ICR definition). All control variables are expressed in percentage terms. Controls for inflation regressions: unemployment rate, commodity import price change, and lagged inflation. Controls for GDP regressions: GFCF/GDP (gross fixed capital formation as % of GDP; source: IMF IFS), credit-to-GDP (private non-financial sector borrowings as % of GDP; source: BIS), population growth, and lagged GDP growth. All explanatory variables are lagged one period. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

cost of lower markups—do they also affect their trading partners? Asia's central role in GVCs—as the world's largest source of manufacturing goods including intermediate inputs—makes this a question of global significance.

We address his question in this section as the main contribution of our analysis. We show that zombie distortions in Asian EMEs transmit to advanced economies through the trade channel, identify the specific mechanism (intermediate goods prices), and demonstrate that the bank lending channel does not operate. Appendix Table A8 shows that zombie firms exhibit significantly lower asset turnover (sales/total assets, not capital turnover)—approximately 4% lower revenue for each dollar of assets—consistent with their volume-over-margin strategy and providing direct micro-level evidence that zombies operate at lower markups.

Before presenting the estimates, we clarify the economic mechanism, which also resolves an apparent conundrum: if zombie firms *reduce* productivity in Asia, how can they *lower* inflation in the advanced economies that import from them? The resolution lies in distinguishing distortion from efficiency. The disinflation is not an efficiency gain from cheaper, more productive exporters; it is the excess-supply distortion of Acharya et al. (2024). Bank evergreening keeps low-productivity firms alive, and their capacity is operated below cost, depressing prices.

The mechanism has two legs, neither of which requires zombies to be productive: a *domestic* leg, through which a higher zombie share lowers an economy's own inflation and output growth (Table 7), and an *international* leg, through which excess export supply from zombie-intensive sectors simultaneously disinflates and displaces production in advanced-economy importers (analysed in this section). The no-zombie counterfactual is therefore the exit of low-productivity firms and price normalization—*higher*, not lower, import prices—so removing zombies would reverse the disinflation we attribute to them, dissolving the conundrum. Our results provide a way to distinguish two mechanisms: a benign improvement in advanced-economy productivity would be a positive terms-of-trade shock that *raises* importer GDP, whereas we find that advanced-economy GDP growth *falls*—inconsistent with an efficient-cheaper-exporter reading and consistent with

distortionary excess capacity that also displaces advanced-economy production.

5.1 Baseline: Trade-Weighted Zombie Spillovers

We assess the spillover effects of Asian zombie firms on advanced economies based on GVC zombie spillover indices that capture exposure to Asian zombie firms. For each advanced economy j at time t, we construct:

$$\text{GVC\_ZombieSpillover}_{j,t} = \sum_{i \in \text{Asia}} w_{j,i}^{\text{import}} \times \text{ZombieShare}_{i,t-1} \tag{8}$$

where $w_{j,i}^{\text{import}}$ is the share of advanced economy j's imports from Asian economy i in j's total imports from *all countries*, averaged over the pre-sample period of 2005–07 to avoid endogeneity.[14] $\text{ZombieShare}_{i,t-1}$ is the asset-weighted share of zombie firms in Asian economy i, lagged by one period. We use the lagged share for two reasons. First, it takes time for zombie firms to produce goods and export them to advanced economy j, so the economically relevant exposure at quarter t is the zombie prevalence already realized in the prior year. Second, the lag makes the spillover index pre-determined relative to the contemporaneous outcomes in our regressions, mitigating simultaneity and reverse-causality concerns. Because the lag is built into the index, the spillover variable enters the subsequent panel regressions contemporaneously rather than being lagged again.

For the aggregate spillover index, we use the asset-weighted average zombie share across the 10 Asian EMEs, so that $\sum_{i \in \text{Asia}} w_{j,i}^{\text{import}} \times \text{ZombieShare}_{i,t-1}$ simplifies to $w_{j,\text{Asia-10}}^{\text{import}} \times \overline{\text{ZombieShare}}_{\text{Asia-10},t-1}$; for the country-disaggregated indices used in Tables 11 and 13 (China vs. Rest-of-Asia), $\text{ZombieShare}_{i,t-1}$ is computed at the corresponding country or sub-group level. Annual zombie shares are linearly interpolated to quarterly frequency for the quarterly panel regressions. All time variation in the index is driven by changes in the zombie share of Asian EMEs across all industries.

[14] We use the all-country denominator rather than an Asia-10-country-only denominator so that the weight measures Asia's actual importance in advanced economy j's trade portfolio, rather than each Asian economy's share within an artificially restricted Asian aggregate. By construction, $\sum_{i \in \text{Asia}} w_{j,i}^{\text{import}} = w_{j,\text{Asia-10}}^{\text{import}}$, the share of advanced economy j's total imports that come from the 10 Asian EMEs. The trade-weighted variant of the index used in Table 8 replaces w^{import} with the analogous bilateral trade weight $w_{j,i}^{\text{trade}}$, also denominated by advanced economy j's total trade with all countries.

We estimate the following quarterly panel specification for 29 advanced economies over 2008Q3–2021Q4:[15]

$$Y_{j,t} = \beta \cdot \text{GVC\_ZombieSpillover}_{j,t} + X'_{j,t-1}\gamma + \mu_j + \tau_t + \varepsilon_{j,t} \tag{9}$$

where $Y_{j,t}$ is CPI inflation (YoY) or real GDP growth (YoY) in advanced economy j. The spillover index enters contemporaneously but already embeds a one-year lag in its construction (equation (8) uses $\text{ZombieShare}_{i,t-1}$). All spillover indices are standardized (mean 0, s.d. 1) within the estimation sample, so β is the effect of a 1 standard deviation increase in exposure. Control variables $X_{j,t-1}$ are lagged one quarter. μ_j are country fixed effects, τ_t are year–quarter fixed effects, and standard errors are clustered at the country level.

Table 8 shows that a 1 standard deviation increase in trade-weighted exposure to Asian zombies reduces advanced economy CPI inflation by approximately 0.14 percentage points ($p < 0.01$) and real GDP growth by 0.41 percentage points ($p < 0.01$). The effects are robust to using import-weighted rather than trade-weighted indices, which lower CPI inflation by 0.09 percentage points ($p < 0.05$) and real GDP growth by 0.42 percentage points ($p < 0.01$).[16]

Dynamic effects. To trace the transmission dynamics, we estimate local projections à la Jordà (2005). For each horizon $h = 0, 1, \ldots, 8$ quarters, we regress the h-period-ahead outcome on the zombie spillover index with the same controls and fixed effects as the baseline regression specifications in Table 8. Figures 3 and 4 plot the impulse response functions.[17]

[15]The 29 advanced economies follow the IMF World Economic Outlook "Advanced Economies" classification, restricted to economies with consistent quarterly CPI, real GDP, and macro-control coverage over 2008Q3–2021Q4. The four Asian advanced economies that overlap with our zombie-share sample of 10 Asian EMEs (Chinese Taipei, Hong Kong SAR, Korea, and Singapore) are excluded from the right-hand side of the spillover regressions so that the same economy does not appear as both source and recipient. The exact country list is available on request.

[16]Appendix Tables A10 and A11 report robustness checks using annual data and an alternative interaction specification ($\text{TradeExposure}_j \times \text{ZombieShare}_{\text{Asia},t-1}$), respectively. The annual data confirm significantly negative effects on GDP growth; the interaction specification yields qualitatively similar results.

[17]As a check against pre-existing trends, we run a robustness check augmenting the local projection with lead terms. It turns out that the lead coefficients at $h = -4$ to -2 are small and statistically

Table 8: Zombie Spillovers to Advanced Economies via GVC

	(1)	(2)	(3)	(4)
	Inflation		Real GDP growth	
SpilloverIndex_Trade	−0.135***		−0.405***	
	(0.036)		(0.094)	
SpilloverIndex_Import		−0.089**		−0.424***
		(0.034)		(0.109)
Unemployment rate	−0.010	−0.011		
	(0.011)	(0.011)		
Commodity price change	0.002	0.002		
	(0.026)	(0.026)		
Output gap	0.041***	0.041***		
	(0.012)	(0.012)		
Inflation	0.791***	0.790***		
	(0.017)	(0.017)		
GFCF/GDP			0.069**	0.064**
			(0.025)	(0.024)
Credit-to-GDP			0.007	0.007
			(0.004)	(0.004)
Population growth			0.044	0.078
			(0.266)	(0.274)
Real GDP growth			0.636***	0.635***
			(0.036)	(0.035)
Country FE	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes
Observations	1,561	1,561	1,188	1,188
R^2	0.894	0.894	0.811	0.812

Notes: Quarterly panel, 29 advanced economies, 2008Q3–2021Q4. Spillover indices are standardized (mean 0, s.d. 1), constructed using pre-determined (2005–07 average) bilateral trade/import weights. All control variables are expressed in percentage terms. Controls for CPI inflation regressions: unemployment rate, commodity import price change, output gap, and lagged CPI inflation (consistent with the controls in Tables 9, 10, 12, and 14). Controls for GDP regressions: GFCF/GDP (gross fixed capital formation as % of GDP; source: IMF IFS), credit-to-GDP (credit to the private non-financial sector as % GDP from the BIS), population growth, and lagged GDP growth. All explanatory variables are lagged one period. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

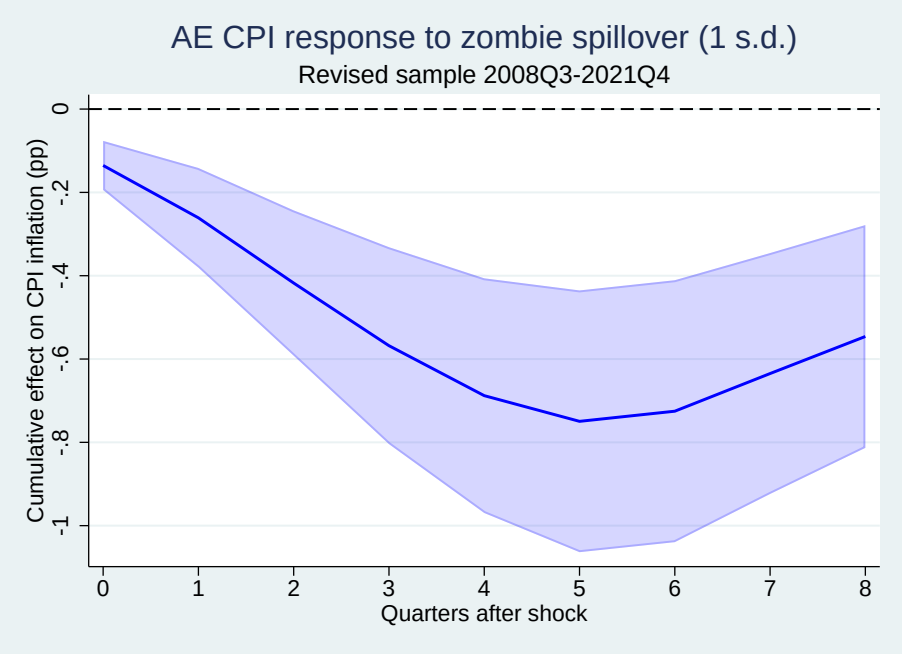

Figure 3: Local Projection: Response of AE CPI Inflation to Zombie Spillover Shock

Notes: Response of advanced economies' CPI inflation (YoY, percentage point) to a 1 standard deviation increase in the trade-weighted zombie spillover index at horizons $h = 0$ to 8 quarters. Each point is an estimate for each horizon from a separate regression with controls and fixed effects as in Table 8. The band shows the 95% confidence interval, clustered at the country level.

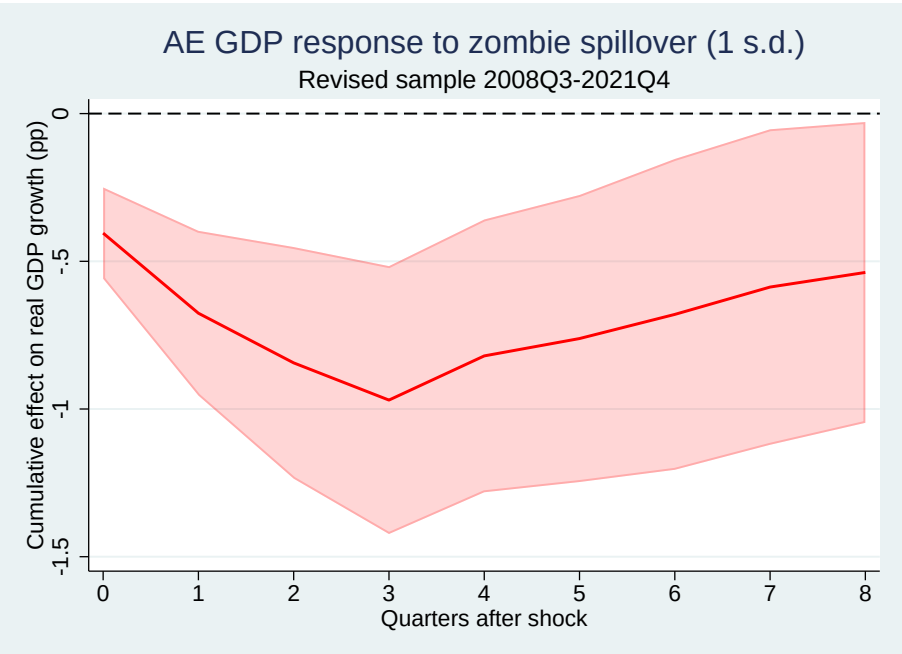

Figure 4: Local Projection: Response of AE GDP Growth to Zombie Spillover Shock

Notes: Same specification as Figure 3 but with real GDP growth (YoY, percentage point) as the dependent variable.

insignificant, so advanced-economy growth does not move ahead of the spillover index. The results are available upon request.

The CPI response builds gradually, reaching a trough of about -0.75 percentage points at $h = 5$ quarters before partially reverting (to about -0.55 by $h = 8$); it remains statistically significant (90% confidence bands) throughout the eight-quarter horizon. This gradual buildup is consistent with the intermediate goods transmission mechanism: lower-priced Asian inputs first reduce production costs for importing firms, then pass through to downstream prices with a lag as firms adjust their own pricing. The GDP growth response is larger on impact (-0.40 pp at $h = 0$) and peaks earlier (-0.97 pp at $h = 3$), consistent with a more immediate output displacement effect as cheaper imports substitute for domestic production. The GDP effect then reverts but remains negative and significant throughout the horizon.[18]

To gauge the economic magnitude of these effects, it helps to translate the standardized coefficients into the realized experience of the sample. Across the 29 advanced economies, the trade-weighted spillover index rose by about 1.1 standard deviations from its 2008 level by 2021, tracking the climb in the Asian zombie share, while a typical elevated year over 2009–2021 sits about 0.75 standard deviations above the 2008 baseline. Reading the dynamic effect off the local projection and scaling it by this realized rise, we find that a typical elevated year lowers advanced-economy CPI inflation by roughly 0.4–0.6 percentage points over the medium run—settling near -0.4 percentage points, which is about a quarter of the 1.5% sample-mean inflation rate. The full 2008–2017 build-up, at the horizon where it bites hardest, lowers it by as much as 0.9 percentage points. For comparison, Acharya et al. (2024) estimate that the post-2012 rise in zombie credit lowered euro-area inflation by up to 0.21 percentage points; our cross-border effect is of the same order of magnitude as this domestic effect. The output effect is of com-

[18]China's 2016 supply-side structural reform provides a complementary policy experiment in reverse: a forced removal of zombie capacity in designated industries (coal, steel, aluminum, cement, and plate glass). In our firm panel, the targeted industries' asset-weighted zombie share collapses from 18% in 2016 to under 4% by 2019, against a much milder decline in other manufacturing, and surviving firms' operating margins recover steadily. Prices moved accordingly: within importer×quarter, European import prices in the targeted industries jump by about 12% relative to other manufactured imports in 2017–18, after declining relatively throughout 2010–16 as the overcapacity built up, and trade-weighted unit values of advanced economies' imports of the targeted products from China rise by a similar magnitude after 2017. Removing zombie capacity raises prices in exactly those industries at exactly that date—the mirror image of the cross-border disinflation we document, and a reversal that an exporter-productivity account of Asian export prices cannot generate.

parable realized size at its trough (about −0.7 percentage points for a typical elevated year) and at medium-run horizons (about −0.4 percentage points).

Identification: zombie-specific or general Asian slowdown? A potential concern is that the zombie spillover index may proxy for broader Asian economic conditions—for instance, a general slowdown in Asian growth that depresses advanced economy outcomes through trade. To address this, we construct a GDP growth spillover index that mirrors the zombie spillover in structure but replaces the zombie share with average real GDP growth across the 10 Asian economies:

$$\text{GDPExposure}_{j,t} = w_j^{\text{trade}} \times \text{AsianGDPGrowth}_{t-1} \tag{10}$$

where w_j^{trade} is the same pre-determined trade weight used in the zombie index. We then include this variable as an additional control in the baseline specification.

Table 9 reports the results. After controlling for GDP growth exposure, the zombie spillover coefficient on CPI inflation not only remains significant but slightly *increases* in magnitude (from −0.135 to −0.143, $p < 0.01$), indicating that the baseline estimate, if anything, understates the zombie-specific effect. For GDP growth, the zombie coefficient is similarly robust (−0.418, $p < 0.01$ vs. −0.405 in the baseline). Meanwhile, the GDP growth exposure variable is significant for CPI (−0.080, $p < 0.05$) but insignificant for GDP growth (−0.121, $p > 0.10$). These results establish that the cross-border disinflation effect is driven specifically by zombie firm prevalence—not by general Asian economic conditions—and that the zombie spillover and Asian growth channels are distinct: the former operates on the supply side through excess capacity and underpricing in zombie-intensive sectors, while the latter captures a broader demand-side linkage that affects prices but not output in advanced economies.

Identification: zombie congestion or exporter productivity gains? A related concern—highlighted by the recent expansion of highly efficient Chinese exporters, for instance in electric vehicles—is that the disinflation we attribute to zombie congestion may instead reflect genuine productivity gains by Asian exporters: cheaper goods from

more efficient producers. Table 10 addresses this concern with a horse race analogous to Table 9, adding a trade-weighted exposure to Asian productivity growth constructed identically to the zombie spillover index (see the table notes for the construction). Productivity exposure is indeed disinflationary for advanced economies (-0.091, $p < 0.01$, column 1), confirming that the productivity channel operates. But it is a distinct channel: with the control in place, the zombie spillover remains negative and highly significant for CPI inflation (-0.207, column 1). The two channels also diverge exactly where theory says they should: productivity exposure does not reduce advanced-economy GDP growth (column 3), whereas the zombie spillover does—a favorable supply shock raises the importer's real income, while a distortionary excess-supply shock displaces its production. Finally, columns 2 and 4 remove China from both sides of the horse race, rebuilding the spillover index and the productivity control on the nine remaining economies: the effects survive at similar magnitudes (-0.242 for CPI and -0.456 for GDP growth), so the result is not driven by China-specific developments such as the electric-vehicle expansion.[19]

Lower prices accompanied by lower output is, however, equally the signature of a negative demand shock: both a contraction in Asian or global demand and a favourable foreign supply shock depress advanced-economy inflation and activity, so the sign of the price response alone cannot separate them, however richly the demand side is controlled. What distinguishes the two is the price–quantity co-movement of trade. A demand contraction lowers advanced economies' imports from Asia in both price and quantity, so their value falls; a favourable supply shock—zombie firms over-producing at depressed prices—lowers Asian export prices (Section 5.2) while *raising* import quantities as cheaper goods displace domestic production, leaving import value flat or rising. The sign of import value change is therefore a direct discriminant of a demand vs. a foreign supply shock. Appendix Table A12 regresses advanced-economy import value from the 10 Asian economies on the spillover index: the index never significantly lowers import value—indeed it turns positive once the common time trend is admitted—whereas advanced-

[19]Consistent with the two channels being distinct, zombie prevalence is not a disguised productivity slowdown: in a country-year panel of the 10 Asian EMEs over 2005–2021, the zombie share and labor-productivity growth are essentially uncorrelated (pooled correlation 0.03, $p = 0.77$; small and positive within country and year fixed effects).

economy GDP growth raises it significantly, confirming that the specification detects demand where it operates yet finds the zombie spillover orthogonal to import value. Since import prices fall (Section 5.2) while import value does not, quantities must rise—the signature of a foreign supply shock, not of a demand contraction.[20]

Table 9: Identification: Zombie Spillover Controlling for Asian GDP Growth Exposure

	(1) CPI YoY Baseline	(2) CPI YoY +GDP exp.	(3) CPI YoY GDP only	(4) GDP YoY Baseline	(5) GDP YoY +GDP exp.	(6) GDP YoY GDP only
SpilloverIndex_Trade (std)	−0.135***	−0.143***		−0.405***	−0.418***	
	(0.036)	(0.037)		(0.094)	(0.102)	
GDP growth exposure (std)		−0.080**	−0.073**		−0.121	−0.100
		(0.035)	(0.034)		(0.186)	(0.183)
Unemployment rate	−0.010	−0.012	−0.016			
	(0.011)	(0.011)	(0.011)			
Commodity price	0.002	0.001	0.002			
	(0.026)	(0.026)	(0.027)			
Output gap	0.041***	0.040***	0.039***			
	(0.012)	(0.012)	(0.012)			
CPI YoY	0.791***	0.791***	0.786***			
	(0.017)	(0.017)	(0.017)			
GFCF/GDP				0.069**	0.071***	0.075***
				(0.025)	(0.024)	(0.026)
Credit/GDP				0.007	0.007	0.006
				(0.004)	(0.004)	(0.004)
Population growth				0.044	0.032	0.030
				(0.266)	(0.252)	(0.225)
GDP YoY				0.636***	0.633***	0.641***
				(0.036)	(0.036)	(0.038)
Observations	1,561	1,561	1,561	1,188	1,188	1,188
R^2	0.894	0.895	0.894	0.811	0.812	0.810
Country & quarter FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table tests whether the zombie spillover effect still holds after controlling for general Asian economic conditions. SpilloverIndex_Trade is the trade-weighted zombie spillover index as defined in Table 8. GDP growth exposure is constructed as $w_j^{\text{trade}} \times \text{AsianGDPGrowth}_{t-1}$, where w_j^{trade} is the same pre-determined (2005–07) trade weight and AsianGDPGrowth is the average real GDP growth across the 10 Asian economies. Both indices are standardized. All control variables are expressed in percentage terms. Controls for CPI: unemployment rate, commodity import price change, output gap, and lagged CPI. Controls for GDP: GFCF/GDP (gross fixed capital formation as % of GDP), credit-to-GDP, population growth, and lagged GDP growth. Columns 1 and 4 replicate the baseline specification; columns 2 and 5 add the GDP growth variable as a control; and columns 3 and 6 include only the GDP growth control. All explanatory variables are lagged one period. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[20]Because the trade statistics report nominal values (price × quantity), the rise in quantity is inferred from flat value and falling prices rather than observed directly. If we use a trade volume series, we could test this more directly.

Table 10: Zombie Spillover vs. Asian Productivity Gains

	(1) CPI YoY +Prod exp.	(2) CPI YoY excl. China	(3) GDP YoY +Prod exp.	(4) GDP YoY excl. China
SpilloverIndex_Trade (std)	−0.207***		−0.439***	
	(0.049)		(0.104)	
SpilloverIndex_Trade, excl. China (std)		−0.242***		−0.456***
		(0.047)		(0.110)
Productivity exposure (std)	−0.091***		−0.040	
	(0.024)		(0.037)	
Productivity exposure, excl. China (std)		−0.081***		−0.011
		(0.020)		(0.031)
Unemployment rate	−0.009	−0.008		
	(0.011)	(0.011)		
Commodity price	−0.002	0.000		
	(0.025)	(0.024)		
Output gap	0.041***	0.042***		
	(0.012)	(0.012)		
CPI YoY	0.786***	0.785***		
	(0.016)	(0.016)		
GFCF/GDP			0.069**	0.069**
			(0.026)	(0.026)
Credit/GDP			0.007	0.006
			(0.004)	(0.004)
Population growth			0.033	0.014
			(0.263)	(0.262)
GDP YoY			0.636***	0.637***
			(0.036)	(0.036)
Observations	1,561	1,561	1,188	1,188
R^2	0.895	0.896	0.812	0.811
Country & quarter FE	Yes	Yes	Yes	Yes

Notes: This table tests whether the zombie spillover effect reflects genuine productivity gains by Asian exporters. Quarterly panel, 29 advanced economies, 2008Q3–2021Q4; the dependent variable is CPI inflation (YoY, %) in columns 1–2 and real GDP growth (YoY, %) in columns 3–4. SpilloverIndex_Trade is the trade-weighted zombie spillover index as defined in Table 8. Productivity exposure is constructed analogously to the GDP growth exposure in Table 9: the pre-determined (2005–07) trade weight times the average labour-productivity growth of the 10 Asian EMEs in the prior year, where each economy's productivity growth is the median within-firm change in log sales per employee among manufacturing firms in our Oriana panel. Sales is measured in nominal terms, so this is revenue productivity, which partly absorbs zombie underpricing itself and thus makes the control conservative. In the "excl. China" columns (2 and 4) both variables are rebuilt without China: the spillover index covers the remaining nine economies, and the productivity exposure uses the rest-of-Asia trade weight times the nine-economy average productivity growth. All indices are standardized within the estimation sample. Controls as in Table 8. All explanatory variables are lagged one period. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.2 Mechanism I: Import Price Channel

To identify the transmission mechanism, we conduct an analysis on the United States, leveraging BLS Import Price Indices by locality of origin. We decompose the zombie spillover index into three geographic sources—China, more developed Asian EMEs (Dev Asia) (Chinese Taipei, Hong Kong SAR, Korea, and Singapore), and four South-East Asian countries (SE Asia) (Indonesia, Malaysia, the Philippines, and Thailand)—matched to the corresponding import price series.[21]

Panel A (first stage) of Table 11 shows that a 1 standard deviation increase in the China (SE Asia) zombie spillover index lowers US import prices from that region by 0.39 (0.56) percentage points ($p < 0.05$). Panel B (second stage) shows that these lower import prices from China, Dev Asia, and SE Asia economies transmit to US CPI with highly significant positive coefficients (0.44, 0.18, and 0.20, respectively, all $p < 0.01$), confirming that lower import prices from Asia translate into lower domestic inflation in the United States. The Sobel test (Panel C) confirms statistically significant indirect effects for China (-0.172, $z = -2.16$, $p = 0.031$) and SE Asia (-0.113, $z = -1.95$, $p = 0.052$).[22]

The channel operates at the border, on *producer* prices: Asian zombies sustain excess capacity that depresses their output (selling) prices, which are advanced-economy importers' input costs. The consumer price index sits further downstream—it is services-heavy and absorbs domestic distribution margins—so it dilutes this signal. A more direct test therefore replaces CPI with producer prices, measured by the S&P Global PMI man-

[21]For completeness, we also examined the broadest available import-price measure: the national-accounts import deflator (OECD QNA, quarterly, available for 27 of the 29 advanced economies), which covers imports of goods and services from all partner countries. The zombie spillover index has no significant effect on this aggregate deflator, while CPI inflation responds significantly on the identical sample. This pattern is natural rather than evidence against the channel. The all-partner deflator is dominated by commodity and exchange-rate movements (its standard deviation is 5.3 percentage points, versus 1.6 for CPI inflation), which dilute the Asia-specific component; and the disinflation does not operate through the direct import share alone—it also works through import competition disciplining domestic producers' prices and through cheaper intermediate inputs. The channel is accordingly visible precisely where it operates: in import prices by origin (Table 11) and in manufacturing input costs (Appendix Table A13).

[22]The US-focused analysis uses a more parsimonious specification than the cross-country panel, reflecting the smaller sample (54 quarterly observations) and the distinct purpose of decomposing the mechanism rather than estimating the aggregate causal effect.

ufacturing input-cost and output-charge (selling-price) indices, a survey-based gauge that central banks use for timely inflation monitoring (monthly data averaged to quarterly; whole-economy surveys for Hong Kong SAR and Singapore, which lack a manufacturing survey). Re-estimating the Table 8 specification with these producer-price indices as the dependent variable (Appendix Table A13), we find that a 1 standard deviation increase in the Asian zombie spillover index lowers advanced-economy manufacturing input prices by about 0.9–1.1 index points and output prices by about 0.4–0.6 points, significant at the 1% level for the trade-weighted index and the 5% level for the import-weighted index. On the *identical* sample, the CPI coefficient is −0.09 and statistically insignificant: the producer prices that sit exactly where the mechanism operates reveal the channel that headline CPI does not capture. The domestic leg shows the same pattern (Appendix Table A14): a one-percentage-point higher *own* zombie share lowers an Asian economy's own manufacturing selling prices by about 0.14 index points and its input prices by about 0.22 points (0.10 and 0.19 once the Table 7 controls are added). This result is the producer-price analogue of the own-economy CPI result in Table 7.

5.3 Mechanism II: Intermediate Goods

To further dig into the underlying zombie spillover exposure channels, We decompose the GVC spillover index by Broad Economic Categories (BEC). In particular, we consider the three broad categories: consumer goods, intermediate goods, and capital goods. We map each SIC 2-digit manufacturing industry and each SITC Revision 3 product category into three BECs—intermediate, capital, and consumer goods—and construct:

$$\text{GVC\_Spillover}^{b}_{j,t} = \sum_{i \in \text{Asia}} w^{b}_{j,i} \times \overline{\text{ZombieShare}}^{b}_{i,t-1} \tag{11}$$

where $b \in \{\text{intermediate, capital, consumer}\}$, $w^{b}_{j,i}$ is the share of advanced economy j's imports of goods in category b from Asian economy i, and $\overline{\text{ZombieShare}}^{b}_{i,t}$ is the average zombie share across SIC 2-digit industries within BEC category b.

Table 12 shows that the intermediate goods channel is the only component that con-

Table 11: Import Price Channel: From Asian Zombie Firms to US Inflation

Panel A: First Stage (SUR) — DV = US Import Prices (YoY%) by Origin

	(1) China	(2) More Developed Asian EMEs	(3) four SE Asian countries
SpilloverIndex_China	−0.390**		
	(0.165)		
SpilloverIndex_Dev Asia		−0.326	
		(0.255)	
SpilloverIndex_SE Asia			−0.563**
			(0.253)
Brent oil price	0.019***	0.070***	0.041***
	(0.005)	(0.009)	(0.009)
FX depreciation	−0.147***	0.017	−0.157***
	(0.038)	(0.065)	(0.048)
N	54	54	54

Panel B: Second Stage (DV = US CPI YoY%)

	(1) CN (Total)	(2) CN (Direct)	(3) Dev Asia (Total)	(4) Dev Asia (Direct)	(5) SE Asia (Total)	(6) SE Asia (Direct)
Spillover_CN	−0.123	0.057				
	(0.248)	(0.160)				
Spillover_Dev Asia			−0.213	−0.153		
			(0.155)	(0.140)		
Spillover_SE Asia					0.063	0.102
					(0.254)	(0.181)
ΔImpPrice_CN		0.441***				
		(0.084)				
ΔImpPrice_Dev Asia				0.180***		
				(0.058)		
ΔImpPrice_SE Asia						0.201***
						(0.050)
Brent oil price	0.029***	0.022***	0.034***	0.020***	0.033***	0.024***
	(0.004)	(0.003)	(0.005)	(0.004)	(0.005)	(0.004)
FX depreciation	−0.057	0.053**	0.029	0.013	0.029	0.045
	(0.035)	(0.025)	(0.040)	(0.035)	(0.026)	(0.028)
Unemp. rate	−0.189	−0.111	−0.060	−0.053	−0.073	−0.097
	(0.119)	(0.076)	(0.073)	(0.063)	(0.110)	(0.081)
N	54	54	54	54	54	54

Panel C: Size of the Indirect Effect — Sobel Test

	China	Dev Asia	SE Asia
α (Spillover → ΔImpPrice)	−0.390**	−0.326	−0.563**
	(0.165)	(0.255)	(0.253)
β (ΔImpPrice → CPI)	0.441***	0.180***	0.201***
	(0.084)	(0.058)	(0.050)
Indirect ($\alpha \times \beta$)	−0.172**	−0.059	−0.113*
	(0.080)	(0.050)	(0.058)
z-statistic	−2.155	−1.182	−1.947
p-value	0.031	0.237	0.052
95% CI	[−0.328, −0.016]	[−0.156, 0.039]	[−0.227, 0.001]

Notes: Three origins of US imports are labelled China, Dev Asia (more developed Asian EMEs: Chinese Taipei, Hong Kong SAR, Korea, and Singapore), and SE Asia (Indonesia, Malaysia, the Philippines, and Thailand). Panel A reports SUR first-stage estimates of the zombie spillover indices on US import prices by origin. Panel B reports the second-stage regressions with US CPI as the dependent variable, organized as one mediation pair per origin. In each pair, the *Total* column (columns 1, 3, 5) omits the regional import-price mediator, so the spillover coefficient measures the total effect of the zombie spillover index on US CPI; the *Direct* column (columns 2, 4, 6) controls for the regional import price as a mediator, so the spillover coefficient is the direct effect that remains after netting out the import-price channel. The difference between the Total-column and the Direct-column coefficients is the implied indirect effect operating through import prices, reported and tested formally in Panel C (Sobel test). All spillover indices are standardized. Standard errors are Newey–West with 4 lags in Panel B; in Panels A and C, standard errors are reported in parentheses. $N = 54$ quarterly observations. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

sistently shows a negative and significant effect on advanced economy inflation (-0.131, $p < 0.05$). Capital goods exposure shows no disinflationary effect, while consumer goods exposure is insignificant for inflation. For GDP growth, intermediate goods exposure is also significantly negative (-0.312, $p < 0.05$). These results confirm that underpriced intermediate inputs from Asian zombie firms reduce downstream production costs in advanced economies—a direct supply-side disinflation channel. The asymmetry across BEC categories is economically intuitive: intermediate goods feed directly into the production process of downstream firms, whereas consumer goods compete in retail markets where distribution margins, branding, and product differentiation attenuate price pass-through.

This intermediate-goods index is the export-relevant zombie-share measure: it weights each Asian source's intermediate-sector zombie share by advanced economies' intermediate-goods import exposure, rather than the economy-wide average zombie share. That the cross-border disinflation operates specifically through this channel—and not through capital- or consumer-goods exposure—indicates that the result reflects zombie distortions concentrated in the traded intermediate-goods sectors that sit upstream in GVCs.

The same decomposition accounts for why advanced-economy *output*, and not only its inflation, declines, and it does so through two of the three channels. The first is the intermediate-goods channel itself: underpriced imported inputs that lower downstream marginal costs also disrupt and substitute for domestic activity along the supply chain, so intermediate-goods exposure is significantly negative for GDP growth (-0.312) as well as for inflation. The second is a consumer-goods channel that is significant for output but *not* for prices (-0.277 for GDP growth, insignificant for CPI in Table 12). This asymmetry is the classic signature of import competition (Autor et al., 2013): cheaper consumer-goods imports take the market share from directly-competing advanced-economy producers, lowering their output, while distribution margins, branding, and product differentiation absorb the price gap, so the effect surfaces in quantities rather than in the consumer price index. Capital-goods exposure, by contrast, is expansionary for both inflation and output, consistent with complementary imported capital. Because these cheaper goods originate in low-productivity zombie capacity rather than in genuine efficiency

gains (Table A7), advanced economies bear the displacement without the terms-of-trade dividend a true productivity improvement would deliver. Consistent with displacement rather than a permanent loss, the local-projection response of GDP growth peaks early and then reverts (Figure 4).

If this output loss is genuine import-competition displacement, it should be driven by *domestic capital formation*—the investment of the firms whose markets are contested—rather than on consumption or government spending. We test this by decomposing advanced-economy real GDP growth into the contributions of its expenditure components and regressing each contribution *separately* on the spillover index, under the same specification as the baseline (Appendix Table A15, built from IMF quarterly national accounts for 28 advanced economies). The result is clear-cut: by far the largest negative contribution is *investment* (-0.66), while government consumption is essentially unaffected ($+0.07$). We also find that the coefficient on the Asian zombie spillover index for net exports is positive ($+0.42$). Private consumption carries only a small negative contribution (-0.28). That the GDP loss is concentrated in private capital formation—and not in government or the external accounts—is the signature of import-competition displacement: zombie-supplied excess capacity contests advanced-economy producers' markets and depresses their investment, exactly as the interpretation predicts.

The cross-border result also holds when the spillover exposure is resolved to the country-industry level. We replace each Asian source economy's aggregate zombie share with its industry-specific zombie shares, weighted by the industry composition of that source's exports to each advanced economy—built from roughly 1,100 UN Comtrade HS 4-digit product lines aggregated into 20 manufacturing industries, a far finer resolution than the aggregate index. Estimated at the annual frequency at which this index varies, the refined measure reproduces *both* cross-border channels: a one-standard-deviation increase lowers advanced-economy CPI inflation by 0.145 percentage points and GDP growth by 0.55 percentage points (Appendix Table A16, both $p < 0.05$).[23]

[23]Interpolating the annual country-industry zombie shares to quarterly frequency as in the baseline index, we find that the refined measure's disinflation effect remains significant in the quarterly panel (CPI -0.058, $p < 0.10$), while the output effect is not.

Table 12: Zombie Exposure via GVC Decomposed by Broad Economic Categories of Goods (Quarterly panel, 29 advanced economies, 2008Q3–2021Q4)

	(1) CPI YoY	(2) CPI YoY	(3) GDP YoY	(4) GDP YoY
GVC Capital (std)	0.044	0.136***	−0.366	0.464***
	(0.044)	(0.026)	(0.395)	(0.137)
GVC Consumer (std)	0.023	0.016	−0.482*	−0.277***
	(0.048)	(0.033)	(0.252)	(0.089)
GVC Intermediate (std)	−0.038*	−0.131**	−0.262	−0.312**
	(0.022)	(0.055)	(0.206)	(0.138)
Unemployment rate	−0.016**	−0.018**		
	(0.006)	(0.008)		
Commodity import price	0.020	0.173***		
	(0.029)	(0.039)		
Output gap	0.060***	0.067***		
	(0.014)	(0.011)		
CPI YoY	0.848***	0.855***		
	(0.016)	(0.009)		
GFCF/GDP			0.079**	0.080*
			(0.029)	(0.041)
Credit/GDP			0.002	0.009*
			(0.002)	(0.005)
Population growth			−0.274	−0.324
			(0.249)	(0.260)
Real GDP YoY			0.639***	0.607***
			(0.034)	(0.029)
Observations	1,955	1,955	1,452	1,452
R^2	0.912	0.840	0.802	0.437
Fixed effects	Ctry & Qtr	Ctry	Ctry & Qtr	Ctry
Cluster	Ctry	Ctry	Ctry	Ctry

Notes: GVC exposure decomposed into intermediate, capital, and consumer goods channels (BEC classification). All GVC exposure variables are standardized. Sample: 29 advanced economies, 2008Q3–2021Q4 (the same panel as Table 8). Controls follow the baseline specification of Table 8; all CPI columns include the lagged output gap as a Phillips-curve control (coefficient reported in the row labelled "Output gap"). All explanatory variables are lagged one period. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.4 Mechanism III: China vs. Rest of Asia

A horse race between zombie spillovers from China and the rest of Asia reveals a striking pattern. Table 13 shows that the rest-of-Asia spillover index is strongly associated with lower advanced economy inflation (-0.14, $p < 0.01$, in column (2) of Panel A) and lower GDP growth (-0.50, $p < 0.01$, in column (2) of Panel B), while the impact of the China spillover index is statistically insignificant for inflation (column (1) of Panel A) and smaller in magnitude for GDP growth (column (1) of Panel B). In the joint specification in column (3) of Panel A, the rest-of-Asia's effect on advanced economy inflation strengthens (-0.17, $p < 0.01$) while China's coefficient turns mildly positive and insignificant. Similarly, in column (3) of Panel B, the rest-of-Asia's effect on advanced economy GDP growth remains significant (-0.40, $p < 0.05$) while China's coefficient turns insignificant. Columns (4) and (5) further break down the rest of Asia into the four Southeast Asian countries (SE Asia) and the four more developed Asian EMEs (Dev Asia), entering each sub-index in a separate regression. Each sub-group's spillover index is disinflationary on its own: the SE Asia index is significantly negative for inflation (-0.05, $p < 0.05$) and GDP growth (-0.22, $p < 0.01$), and the Dev Asia index is strongly negative for inflation (-0.12, $p < 0.01$) and negative, though insignificant, for GDP growth (-0.34). In the three-way joint specification in column (6), the Dev Asia effect on advanced economy inflation remains significant (-0.12, $p < 0.01$) while the SE Asia coefficient is insignificant; for GDP growth, the Dev Asia effect remains marginally significant (-0.36, $p < 0.1$) and larger in magnitude than China's effect (-0.22, $p < 0.05$), while the SE Asia coefficient is insignificant. These results show that the zombie spillover via GVC to advanced economy inflation and GDP growth is driven mainly by the four more developed Asian EMEs.

This pattern reflects a compositional difference in export structure. China's exports to advanced economies are dominated by consumer goods (41.9%) and capital goods (25.8%), with intermediate goods accounting for only 32.4%. In contrast, other Asian economies have intermediate-goods export shares that range from substantial to dominant: Indonesia (69.2%), India (64.7%), the Philippines (62.9%), Singapore (61.1%), Malaysia (55.6%), and Korea (49.0%) all send a meaningfully larger share of their exports

to advanced economies as intermediate inputs than China does.[24] When zombie firms in these intermediate-goods-exporting economies sell underpriced inputs, the cost reduction feeds directly into the production process of downstream firms in advanced economies, lowering marginal costs and ultimately consumer prices. China's zombie firms, by contrast, mainly export finished goods that compete with domestic products in advanced economy retail markets, where the pass-through is weaker.[25]

The China vs. rest-of-Asia ordering is robust to the choice of weight base year (Appendix Table A17). One refinement is worth noting: when the bilateral weights are built from recent (2019–20) trade rather than the pre-determined 2005–07 average, China's GDP spillover becomes significant even jointly with the rest of Asia (-0.16, $p < 0.05$), consistent with the shift in China's export structure toward intermediate goods in recent years. The disinflation channel, however, continues to operate mainly in the rest of Asia.

A further reason China's *direct* coefficient is muted is that its zombie distortions are absorbed within Asia before reaching advanced economies. At the firm level, non-China Asian manufacturing firms in more China-import-dependent economies, in sectors where China is more zombie-ridden, post significantly lower gross margins (Appendix Table A18: -0.13, $p < 0.05$, sector-by-year shocks absorbed), and the compression is, if anything, larger among their *healthy non-zombie* peers (-0.17, $p < 0.05$)—the margin squeeze that Chinese import penetration through underpriced intermediate inputs inflicts on firms elsewhere in Asia.[26] China's underpriced output compress firms' margins in the region first, which indirectly affects advanced economies via the pass-through of lower prices.

[24]Export shares are computed from UN Comtrade SITC Revision 3 2-digit bilateral trade data, averaged over 2005–07, with SITC codes mapped to BEC categories (intermediate/capital/consumer). For Korea and Singapore, the substantial intermediate-goods share reflects the dominance of electronic components and chemical intermediates in their exports to advanced economies. Chinese Taipei is not separately reported in UN Comtrade and is therefore excluded from this comparison, although its export structure resembles Korea's, with electronic intermediates dominating its exports to advanced economies.

[25]The analysis in Table 11 and the horse race in Table 13 are complementary rather than contradictory. The US-focused analysis finds a significant China channel because the US is by far the largest destination for Chinese exports; in the cross-country panel, this effect is diluted by the many advanced economies with weaker trade links to China.

[26]Chandrasakha and Qiu (2026) use Thai firm-level data and examine how Thai firms' exposure to Chinese import penetration affects their performance. They find that higher Chinese import penetration is associated with a decline in Thai firms' profitability and labor productivity. This adverse effect is concentrated in exposure arising from upstream industries supplying intermediate inputs. They claim that this pattern is consistent with an indirect supply chain and competition channel, in which cheaper Chinese inputs intensify product-market competition and compress Thai manufacturing sectors' margins.

Table 13: China vs. Rest-of-Asia Zombie Spillovers to Advanced Economies: Two-way and Three-way Horse Race

	(1) CN alone	(2) RestAsia alone	(3) CN+RestAsia joint	(4) SE Asia alone	(5) Dev Asia alone	(6) 3-way joint
Panel A: CPI YoY						
SpilloverIndex_China	−0.025		0.040			0.015
	(0.023)		(0.025)			(0.033)
SpilloverIndex_RestAsia		−0.135***	−0.172***			
		(0.046)	(0.062)			
SpilloverIndex_SE Asia				−0.047**		−0.057
				(0.020)		(0.048)
SpilloverIndex_Dev Asia					−0.120***	−0.119***
					(0.042)	(0.039)
Unemployment rate	−0.026**	−0.023**	−0.023**	−0.026**	−0.023**	−0.023**
	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Commodity price	−0.003	−0.005	−0.005	−0.003	−0.004	−0.005
	(0.027)	(0.026)	(0.026)	(0.027)	(0.026)	(0.026)
CPI YoY	0.798***	0.801***	0.800***	0.799***	0.798***	0.800***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.016)
Observations	1,561	1,561	1,561	1,561	1,561	1,561
R^2	0.892	0.892	0.893	0.892	0.892	0.893
Panel B: GDP YoY						
SpilloverIndex_China	−0.258***		−0.107			−0.221**
	(0.084)		(0.094)			(0.103)
SpilloverIndex_RestAsia		−0.498***	−0.398**			
		(0.132)	(0.158)			
SpilloverIndex_SE Asia				−0.218***		−0.061
				(0.054)		(0.103)
SpilloverIndex_Dev Asia					−0.345	−0.355*
					(0.251)	(0.194)
GFCF/GDP	0.071***	0.060**	0.061**	0.069**	0.063**	0.060**
	(0.023)	(0.026)	(0.024)	(0.027)	(0.024)	(0.022)
Credit/GDP	0.008	0.006	0.007	0.006	0.006	0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Population growth	0.096	0.038	0.062	0.071	0.001	0.056
	(0.263)	(0.277)	(0.282)	(0.264)	(0.249)	(0.279)
GDP YoY	0.637***	0.636***	0.635***	0.639***	0.639***	0.633***
	(0.036)	(0.036)	(0.035)	(0.036)	(0.036)	(0.034)
Observations	1,188	1,188	1,188	1,188	1,188	1,188
R^2	0.811	0.812	0.812	0.811	0.811	0.812
Country & time FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Country	Country	Country	Country	Country	Country

Notes: Horse race between China and the rest of Asia. Panel A reports CPI inflation regressions and Panel B reports GDP growth regressions; in each panel, columns 1–3 present the two-way decomposition of the zombie spillover index (China alone, Rest-of-Asia alone, and jointly) and columns 4–6 the three-way decomposition (SE Asia alone, Dev Asia alone, and the three-way joint specification including China). **Rest-of-Asia** (columns 2–3) covers the nine non-China Asian EMEs: Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Chinese Taipei, and Thailand. The three-way decomposition splits this group into **SE Asia** (four Southeast Asian countries: Indonesia, Malaysia, the Philippines, Thailand) and **Dev Asia** (four more developed Asian EMEs: Chinese Taipei, Hong Kong SAR, Korea, Singapore); India is held out of the three-way decomposition because of its limited bilateral export weight to most advanced economies. All indices are standardized within the estimation sample. Controls as defined in Table 8. All explanatory variables are lagged one period. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.5 Bank Lending-Weighted Zombie Spillovers

As another channel of Asian EME zombie firms affecting advanced economies, we construct a bank lending-weighted spillover index using bilateral foreign claims on the non-

bank private sector from the BIS Consolidated Banking Statistics (CBS), with pre-determined (2005–07 average) weights, and estimate the same panel specification as the baseline. The Bank-lending zombie spillover index is constructed as follows:

$$\text{Bank\_ZombieSpillover}_{j,t} = \sum_{i \in \text{Asia}} w_{j,i}^{\text{bank}} \times \text{ZombieShare}_{i,t-1} \tag{12}$$

where $w_{j,i}^{\text{bank}}$ is the share of advanced economy j-headquartered reporting banks' foreign claims on Asian economy i's non-bank private sector in their total foreign claims to all counterparty countries, averaged over 2005–07. CBS is nationality-based on the bank side: it consolidates the claims of all branches and subsidiaries of advanced economy j-headquartered banks regardless of where those offices are located, so the index is a clean measure of advanced economy j-headquartered banks' aggregate exposure to zombie firms located in Asian EMEs via lending. We use CBS rather than the residency-based BIS Locational Banking Statistics (LBS) because the relevant decision-making unit and the consolidated balance-sheet outcome examined in Section 5.6 are both at the nationality of the lending group. The CBS sample covers 18 advanced economies (relative to the 13 covered by the residency-based LBS), which expands the panel to 967 country-quarter observations for the CPI regression and 972 for the GDP regression.[27]

Table 14 shows that, in contrast to the significant trade channel, the bank-lending zombie spillover index is statistically insignificant for both CPI inflation (-0.027, $p = 0.40$) and real GDP growth (-0.232, $p = 0.17$), with economically modest point estimates and the same negative sign as the trade channel. This sharp divergence—trade transmits, but bank lending does not—raises the question of *why* the bank lending channel does not operate. We provide the micro-level answer in the next two subsections.

[27] As a robustness check, we have also examined an alternative definition in which $w_{j,i}^{\text{bank}}$ is the share of advanced economy j-headquartered banks' claims on Asian EME i within their total claims on the 10 Asian EMEs only (rather than on all counterparty countries). The null result on the bank-lending channel is unchanged.

Table 14: Bank Lending Channel: Zombie Spillover through International Banking Exposure (CBS)

	(1) CPI YoY	(2) GDP YoY
SpilloverIndex_BankLoan (std)	−0.027	−0.232
	(0.031)	(0.160)
Unemployment rate	−0.009	
	(0.008)	
Commodity price	−0.018	
	(0.048)	
Output gap	0.041**	
	(0.017)	
CPI YoY	0.837***	
	(0.017)	
GFCF/GDP		0.084***
		(0.021)
Credit/GDP		0.006
		(0.005)
Population growth		−0.193
		(0.224)
GDP YoY		0.643***
		(0.039)
Country & time FE	Yes	Yes
Cluster	Country	Country
Observations	967	972
R^2	0.894	0.818

Notes: The bank-lending-weighted spillover index is constructed using bilateral foreign claims on the non-bank private sector from BIS Consolidated Banking Statistics (CBS), with pre-determined (2005–07 average) weights, defined as $w_{j,i}^{\text{bank}}$ = (CBS foreign claims of j-headquartered banks on Asian EME i's non-bank private sector on an ultimate guarantor basis) / (CBS foreign claims of j-headquartered banks on all counterparty countries on an ultimate guarantor basis). The sample covers 18 advanced economies with non-missing CBS coverage to the 10 Asian EMEs over the pre-determined window (the LBS-based version covered only 13 advanced economies). Controls as defined in Table 8. All explanatory variables are lagged one period. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.6 Zombie Exposure and Bank Health

The preceding subsections establish that zombie distortions in Asia transmit to advanced economies through goods markets, but not through the banking system. This asymmetry demands explanation. Since the 2007–08 GFC, the cross-border transmission of financial risk through internationally active banks has been a central concern and a major focus of regulatory reform (Cetorelli and Goldberg, 2012; Claessens and Van Horen, 2014). Post-crisis tools targeting cross-border banking risk—the Financial Stability Board's Key Attributes of Effective Resolution Regimes for cross-border resolution of global systemically important banks (G-SIBs), supervisory colleges for internationally active groups, and the BIS CBS as the principal surveillance dataset—were designed precisely to monitor and contain the propagation of banking-sector vulnerabilities across borders. Our null result on the bank lending channel suggests that, at least for zombie-related risks, the banking system does *not* serve as a conduit for zombie distortions.

If foreign banks successfully contain zombie risk on their balance sheets, the resulting financial stability may *obscure* the real-economy damage that zombie firms inflict through trade. Policymakers who monitor cross-border risk primarily through indicators for foreign banks such as loan quality and capital adequacy will observe no deterioration in foreign banks' health, and may conclude that Asian zombie prevalence poses no threat to the banks headquartered in the foreign countries and thus the inflation and GDP growth of these economies. Our results show that this conclusion would be premature: the disinflationary spillover arrives not through bank balance sheets but through import prices, a channel that falls outside the perimeter of traditional financial surveillance. Understanding *why* the bank lending channel is shut down is therefore essential.

We address this question by examining how zombie exposure affects bank health, distinguishing between domestic and foreign banks.

We examine whether zombie lending feeds back to bank health:

$$\text{BankHealth}_{j,t} = \beta \cdot \text{LoanToZombie}_{j,t-1} + X'_{j,t-1}\gamma + \mu_j + \tau_t + \varepsilon_{j,t} \tag{13}$$

where BankHealth is the NPL ratio, ROA, or ROE, μ_j are bank fixed effects, and τ_t are year fixed effects.

Table 15 reports results across four panels. Panel A (all banks) shows that a 1 percentage point increase in the share of a bank's loans to zombie firms raises its NPL ratio by 0.019 percentage points ($p < 0.01$) and lowers ROA by 0.002 percentage points ($p < 0.10$). Panel B restricts the sample to non-Asian foreign banks: the coefficients are statistically insignificant for both NPL and ROA, confirming that foreign banks are insulated. Panel C restricts the sample to banks headquartered in the 10 Asian economies and further decomposes zombie lending into loans extended by a foreign bank headquartered in one of the 10 Asian economies (that is, a bank's lending to firms in an economy where the bank is not headquartered in the economy) and loans extended by a domestic bank.

The results reported in Panels A to C indicate that the results reported in Panel A (columns (1) and (2)) for all banks and the results reported in Panel C (columns (7) and (8)) are driven by the results for domestic banks reported in columns (10) and (11). The results are striking: loans extended as a domestic bank significantly raise NPLs (0.065, $p < 0.01$) and lower ROA (-0.006, $p < 0.05$), while loans extended as a foreign bank are associated with marginally *lower* NPLs (-0.010, $p < 0.10$) and have no significant effect on ROA. Panel D splits the non-Asian foreign banks of Panel B into two subsamples by headquarters location—banks headquartered in 29 advanced economies (AE-HQ) and banks headquartered in EMEs outside Asia (EME-HQ)—and adds a stacked specification with an explicit AE-home interaction. Neither subsample shows a statistically significant relation between zombie lending and bank health, and a formal coefficient-equality test cannot reject that the AE-HQ and EME-HQ point estimates are the same ($p = 0.80$ for NPL, $p = 0.98$ for ROA). The interaction column confirms the same point: foreign banks headquartered outside the Asian economies are insulated, regardless of whether their home country is an advanced economy or an EME.

Table 15: Zombie Lending and Bank Health: Domestic vs. Foreign Banks

	Panel A: All banks (sum of B + C)			*Panel B: Extra-EME Asia regional banks*		
	(1) NPL	(2) ROA	(3) ROE	(4) NPL	(5) ROA	(6) ROE
LoanToZombie	0.019***	−0.002*	−0.031***	0.007	0.001	0.006
	(0.006)	(0.001)	(0.010)	(0.006)	(0.001)	(0.012)
Log(TA)	−0.313	−0.153	−1.124**	−0.028	−0.437***	−3.346***
	(0.249)	(0.107)	(0.482)	(0.770)	(0.120)	(0.994)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3,529	3,843	3,827	1,206	1,375	1,369
R^2	0.015	0.012	0.015	0.002	0.034	0.036

	Panel C: EME Asia regional + domestic banks						*Panel D: Non-Asia foreign banks (AE-HQ vs. EME-HQ)*					
	Aggregate			Decomposed			Interaction		AE-HQ subsample		EME-HQ subsample	
	(7) NPL	(8) ROA	(9) ROE	(10) NPL	(11) ROA	(12) ROE	(13) NPL	(14) ROA	(15) NPL	(16) ROA	(17) NPL	(18) ROA
LoanToZombie	0.025***	−0.002**	−0.045***				0.009	0.001	0.008	0.000	0.012	0.001
	(0.008)	(0.001)	(0.013)				(0.008)	(0.003)	(0.009)	(0.001)	(0.008)	(0.003)
Intra-EME Asia regional				−0.010*	0.001	0.001						
				(0.005)	(0.001)	(0.010)						
EME Asia domestic				0.065***	−0.006**	−0.087***						
				(0.013)	(0.002)	(0.025)						
LoanToZombie × AE home$_{t-1}$							−0.003	−0.000				
							(0.011)	(0.003)				
Log(TA)	−0.759**	−0.073	0.351	−0.759**	−0.075	0.323	0.025	−0.508***	−0.054	−0.409**	−0.457	−0.267
	(0.345)	(0.144)	(0.522)	(0.310)	(0.144)	(0.493)	(0.489)	(0.133)	(1.159)	(0.161)	(0.738)	(0.158)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,323	2,468	2,457	2,323	2,468	2,457	1,205	1,374	908	1,022	297	352
R^2	0.036	0.007	0.016	0.092	0.016	0.033	0.566	0.661	0.546	0.647	0.629	0.587
p(AE-HQ = EME-HQ)									0.797 (NPL)		0.984 (ROA)	

Notes: Dependent variables: NPL ratio, ROA, and ROE (all in %), as indicated in the column headers. ROE (columns 3, 6, 9, and 12) is derived as ROA divided by the equity-to-assets ratio (both from SNL Financial) and winsorized at the 1st/99th percentiles; SNL does not report ROE directly. The bank sample is partitioned into three mutually exclusive categories whose union is the universe of banks in our matched sample. Panel B (*Extra-EME Asia regional banks*) covers banks headquartered outside the 10 Asian EMEs (i.e. non-Asian foreign banks). Panel C (*EME Asia regional + domestic banks*) covers banks headquartered inside the 10 Asian EMEs and decomposes their lending in columns 10–12 into "Intra-EME Asia regional" loans (an Asia-10 bank lending to firms in another Asia-10 country) and "EME Asia domestic" loans (an Asia-10 bank lending to firms in its own home country), each scaled by total loans. Panel A reports the aggregate across all banks (the sum of Panels B and C). Panel D splits Panel B by headquarters location: columns 13–14 report a stacked specification with an AE-home interaction; columns 15–16 restrict to banks HQ'd in 29 advanced economies; columns 17–18 restrict to banks HQ'd in EMEs outside Asia. The last row reports the p-value of a coefficient-equality test on L.LoanToZombie between the AE-HQ and EME-HQ subsamples, estimated from the stacked interacted regression: AE-HQ and EME-HQ banks exhibit the same (statistically zero) sensitivity of bank health to Asian zombie lending. Bank and year FE are included. The R^2 values reported in Panels A–C are *within*-R^2 after absorbing bank and year fixed effects; the bulk of the variation in bank health is between-bank and is absorbed by the bank fixed effects. All explanatory variables are lagged one period. Standard errors clustered at the bank level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The impairment is even clearer in equity returns. SNL Financial does not report ROE directly, so we derive it as ROA divided by the equity-to-assets ratio (columns (3), (6), (9), and (12)). A 1 percentage point increase in a bank's zombie loan share lowers its ROE by 0.031 percentage points (column (3)): a one-within-bank-standard-deviation (16 percentage point) increase in zombie lending costs about 0.5 percentage points of ROE against a sample mean of 10.9%, and 0.7 percentage points for banks headquartered in the ten Asian EMEs (column (9)). The decomposition in column (12) shows that, as with NPLs and ROA, the equity-return cost is borne entirely on domestic lending: zombie loans extended as a domestic bank lower ROE by 0.087 percentage points ($p < 0.01$), while loans extended as a foreign bank within the region have no effect. Non-Asian foreign banks show no ROE impairment either (column (6)): the balance-sheet cost of zombie lending falls on the domestic and regional banks that do the evergreening.[28]

5.7 Reconciling Trade and Bank Lending Channels

The results paint a coherent picture that ties together the bank–zombie nexus (Section 3.2), cross-border spillovers (Sections 5.1–5.5), and bank-health evidence (Section 5.6).

Foreign banks are exposed to Asian zombie firms and maintain those lending relationships over time—indeed, with higher persistence than domestic banks (Appendix Table A3). The null bank-lending channel result is therefore not driven by foreign banks reducing their zombie exposure; on the contrary, they keep it on the books. What explains the null is twofold. First, Asian EME zombie exposure is small relative to non-Asian foreign banks' consolidated portfolios, so even adverse outcomes on that small share do not materially move group-level bank health. Second, on that small exposure, foreign banks' "maintain and monitor" approach—likely involving tighter loan covenants, more rigorous monitoring, and selective restructuring—contains zombie-related risk. The combination of small consolidated weights and effective risk management on that small slice is what

[28]Direct bank-failure tests are infeasible in our sample, as SNL provides no failure or exit flags. The recent Chinese experience is nonetheless consistent with zombie exposure impairing the marginal lenders: China's small regional banks—the city and rural commercial banks most exposed to local government financing vehicles (LGFVs), whose loans are systematically evergreened (Gao et al., 2021)—operate with record-low net interest margins and NPL ratios roughly twice the system average, and are being consolidated at scale, with some 290 rural banks merged into provincial-level entities in 2024 alone, following the failures or rescues of Baoshang, Jinzhou, and Hengfeng in 2019.

keeps bank balance sheets intact (Table 15) and prevents zombie risk from travelling through the banking system to affect macroeconomic outcomes in banks' home countries (Table 14).

The trade channel operates through a fundamentally different mechanism. Zombie firms—kept alive by bank forbearance—produce and export goods at prices that stem from excess capacity and depress markups. This price competition transmits directly through goods markets: advanced economies that import more intermediate goods from zombie-intensive Asian economies experience lower import prices and, consequently, lower CPI inflation. Unlike the banking channel, this transmission mechanism is decentralized and cannot be "managed away" by any individual institutions' risk management.

The divergence between the two channels carries a clear policy implication: cross-border risk surveillance that focuses exclusively on bank exposures will miss a significant source of international zombie transmission. Monitoring corporate health across GVC-connected economies—not just bank health—is essential.

6 Conclusion

This paper documents that zombie-firm distortions transmit across borders through international trade—a channel that has not been identified in the literature. Using firm-bank linked data from 10 Asian EMEs, we establish a causal chain from bank evergreening, through domestic real-economy drag, to cross-border disinflation in advanced economies via trade linkages. The disinflationary spillover operates through the intermediate goods import price channel and is driven by non-China Asian EMEs whose exports are concentrated in intermediate goods. By contrast, the cross-border bank lending channel does not transmit: foreign banks absorb zombie exposure without balance sheet deterioration, insulating the international banking system from zombie risk in Asian EME firms.

These findings carry implications for monetary policy and financial surveillance. For central banks in advanced economies, zombie prevalence in GVC-connected Asian EMEs represents an external supply-side disinflationary force operating through import prices—beyond the reach of domestic monetary policy. For financial regulators, zombie distortions

in Asian EMEs spread globally through goods markets: bank-focused surveillance alone is insufficient. Integrated monitoring of corporate health across GVC-connected economies is needed to capture this dimension of cross-border risk.

More broadly, our results highlight that the international transmission of financial distortions need not follow financial channels. In a world of deep trade integration, domestic misallocation driven by zombie firms and sustained by weak banks' forbearance can generate price externalities that travel through supply chains to affect inflation and output in distant economies. Understanding these real-economy spillovers is increasingly important as GVCs continue to reshape the geography of production and price formation.

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Appendix Tables and Figures

Table A1: Sample Coverage by Economy

	Firm panel, 2008–2020				Firm–bank matched sample		
	Firms	Firm-years	Zombie share (%) by number	by assets	Firms with matched banks	Banks	of which foreign
China	12,577	97,006	9.1	6.0	153	58	14
Hong Kong SAR	473	2,609	8.5	23.2	464	92	87
India	51,361	233,846	16.0	14.2	10,539	146	97
Indonesia	651	5,707	14.8	9.9	30	20	15
Korea	417,949	2,003,727	7.5	11.2	2,112	13	3
Malaysia	3,201	19,008	11.7	7.6	1,290	113	91
Philippines	13,597	37,439	3.4	2.0	84	28	17
Singapore	648	6,304	18.8	2.7	403	134	125
Thailand	212,904	1,006,808	12.1	10.2	45	18	11
Chinese Taipei	3,468	9,664	8.5	19.4	–	–	–
Total	716,829	3,422,118			15,120	622	460

Notes: Firm panel: Oriana (Bureau van Dijk) firm-year observations with a computable interest coverage ratio over 2008–2020, the years for which zombie status can be determined under the three-year rule of Section 3; financial firms and non-profits are excluded. The figures in the "Zombie share" columns are the share of zombie firms by number of firms and by total assets, pooled over 2008–2020 within each economy. Firm–bank matched sample: firms whose main banks (top five) are matched to SNL Financial bank financials; The figures in the "Banks" column count bank–country units, the cross-sectional unit of the bank-level regressions in Tables 2 and 15 (a bank lending in two economies is counted in each); 622 bank–country units correspond to 326 distinct banks. Foreign banks are banks headquartered outside the economy in which they lend. The bank-level regressions use the subset of bank–country–years with non-missing lagged bank financials (583 bank–country units).

Table A2: Persistence of Zombie Lending: Continuous Interaction Terms

DV: LoanToZombie	(1)	(2)	(3)	(4)
Lagged LoanToZombie	0.556***	0.529***	0.412***	0.514***
	(0.011)	(0.015)	(0.034)	(0.049)
NPL ratio × Lagged LoanToZombie		0.013**		−0.047**
		(0.006)		(0.019)
Lending rate × Lagged LoanToZombie			0.024***	0.008
			(0.005)	(0.008)
Lending rate × NPL ratio				0.023
				(0.051)
Lending rate × NPL ratio × Lagged LoanToZombie				0.007***
				(0.002)
NPL ratio		−0.077	−0.025	−0.221
		(0.140)	(0.138)	(0.373)
Lending rate	0.303	0.224	0.187	0.100
	(0.296)	(0.296)	(0.296)	(0.333)
Tier 1 ratio	−0.016	−0.057	−0.066	−0.062
	(0.086)	(0.086)	(0.086)	(0.086)
Liquid asset ratio	−0.004	−0.002	−0.002	−0.003
	(0.022)	(0.022)	(0.022)	(0.022)
Loan-to-deposit ratio	0.004	0.005	0.005	0.005
	(0.014)	(0.014)	(0.014)	(0.014)
Bank ROA	0.177	0.347	0.291	0.248
	(0.467)	(0.467)	(0.466)	(0.467)
Bank–country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	6,017	6,017	6,017	6,017
R^2	0.616	0.616	0.617	0.618

Notes: The dependent variable is the share of a bank's loans to zombie firms (%). Interactions use the continuous lending rate and the NPL ratio (not the High NPL dummy in Table 2). Column 1 reports the baseline specification with lending rate but *without* the lagged NPL ratio (which is insignificant outside the interactions), so that columns 1, 3, and 4 share a common baseline and the NPL ratio only enters in columns 2 and 4 through the interaction terms. Column 4 reports the triple-interaction (DiDiD) specification. All explanatory variables are lagged one period. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A3: Persistence of Zombie Lending: Foreign vs. Domestic Banks

	(1)	(2)	(3)	(4)
Sample	Foreign	Domestic	Foreign	Domestic
Lagged LoanToZombie	0.588***	0.409***	0.546***	0.462***
	(0.012)	(0.026)	(0.014)	(0.032)
Lagged LoanToZombie × High NPL			0.103***	−0.132***
			(0.020)	(0.047)
High NPL			−0.206	1.871**
			(0.639)	(0.843)
Tier 1 ratio	−0.009	−0.241**	−0.013	−0.223*
	(0.097)	(0.121)	(0.096)	(0.121)
Liquid asset ratio	0.022	−0.001	0.020	0.001
	(0.041)	(0.019)	(0.040)	(0.019)
Loan-to-deposit ratio	0.009	0.003	0.008	−0.001
	(0.017)	(0.024)	(0.017)	(0.024)
Bank ROA	0.451	−0.100	0.517	−0.080
	(0.503)	(0.770)	(0.480)	(0.746)
Observations	5,103	1,303	5,103	1,303
R^2	0.619	0.491	0.621	0.495
Bank–country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: Columns (1)–(2) and (3)–(4) re-estimate columns (1) and (2) of Table 2, respectively, separately for foreign and domestic bank subsamples. A bank is classified as foreign if it is headquartered outside the country in which the lending takes place, that is, a firm borrowing from the bank is located. The dependent variable is the share of a bank's loans to zombie firms (%); High NPL equals one if a bank's NPL ratio exceeds the cross-bank annual median. The coefficient on the Tier 1 ratio for domestic banks is substantially larger in size than that for foreign banks and statistically significant: when domestic banks' Tier 1 ratio falls, they tend to increase their zombie lending share. All regressions include bank–country and year fixed effects. All explanatory variables are lagged one period. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A4: Credit Sensitivity to bank health: Zombie vs. Non-Zombie Firms (Broader Sample)

	(1)	(2)	(3)	(4)	(5)	(6)
	Log(debt)		Leverage		Debt growth	
Sample	Zombie	Non-zombie	Zombie	Non-zombie	Zombie	Non-zombie
Tier 1 ratio	−0.025	0.005	0.004	0.000	−0.015	0.005
	(0.029)	(0.008)	(0.006)	(0.000)	(0.021)	(0.005)
Liquid asset ratio	0.014*	−0.009***	0.003	−0.001**	0.015***	0.001
	(0.007)	(0.003)	(0.002)	(0.000)	(0.006)	(0.002)
NPL ratio	−0.002	−0.015**	0.006	−0.003**	−0.029***	−0.019***
	(0.016)	(0.006)	(0.008)	(0.001)	(0.009)	(0.003)
Lending rate	−0.010	0.106***	0.023*	0.011***	0.011	0.001
	(0.080)	(0.019)	(0.012)	(0.002)	(0.055)	(0.010)
Log size	0.537***	0.954***	−0.031**	0.029***	−0.205***	−0.218***
	(0.079)	(0.038)	(0.015)	(0.004)	(0.051)	(0.019)
Sales growth	−0.018	−0.001	−0.001	−0.002	−0.004	0.007
	(0.021)	(0.012)	(0.003)	(0.001)	(0.020)	(0.010)
Tangible assets	0.931***	1.276***	0.060	0.129***	−0.361**	−0.423***
	(0.244)	(0.138)	(0.042)	(0.015)	(0.176)	(0.073)
Observations	3,881	25,919	4,050	29,901	4,026	26,883
R^2	0.915	0.894	0.844	0.775	0.289	0.184
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Same specification as Table 3 but using the broader zombie/non-zombie split (including firms that transition between states). All explanatory variables are lagged one period. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A5: Zombie Firms and Minimal Debt Adjustment

	(1)	(2)	(3)	(4)
DV:	|Debt gr.| <10%	|Debt gr.| <5%	|Debt gr.| <10%	|Debt gr.| <5%
Zombie dummy (ICR)	0.026***	0.015***		
	(0.007)	(0.005)		
Always zombie dummy (ICR)			0.083***	0.048***
			(0.006)	(0.004)
Log size	0.049***	0.029***	0.017***	0.010***
	(0.004)	(0.003)	(0.001)	(0.001)
Sales growth	−0.003*	−0.002*	−0.010***	−0.007***
	(0.002)	(0.001)	(0.002)	(0.002)
Tangible assets	0.159***	0.067***	0.137***	0.067***
	(0.018)	(0.014)	(0.009)	(0.007)
Firm FE	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes
Observations	81,221	81,221	55,016	55,016
R^2	0.259	0.207	0.043	0.031

Notes: The dependent variable is an indicator for the absolute value of debt growth below 10% (columns 1, 3) or below 5% (columns 2, 4). All explanatory variables are lagged one period. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A6: Zombie Status and Firm Performance: Robustness

Panel A: Excluding Persistent Zombies and Transition Windows

	(1) ROA (%)	(2) Sales gr.	(3) ROA (%)	(4) Sales gr.	(5) ROA (%)	(6) Sales gr.	(7) ROA (%)	(8) Sales gr.
	Excl. persistent		Window [−1,0]		Window [−1,1]		Window [−1,2]	
Zombie dummy (ICR)	−3.195***	−0.005	−0.641***	−0.117***	−3.201***	−0.038	−2.342***	0.018
	(0.076)	(0.009)	(0.120)	(0.018)	(0.180)	(0.028)	(0.146)	(0.022)
Observations	935,285	887,528	32,236	32,242	62,132	60,920	82,962	80,408
R^2	0.473	0.300	0.730	0.530	0.658	0.471	0.612	0.404

Panel B: Pre-2013 vs. Post-2013 Subsample

	(1) ROA (%) Up to 2013	(2) ROA (%) After 2013	(3) Sales gr. Up to 2013	(4) Sales gr. After 2013
Zombie dummy (ICR)	−0.323	−2.187***	−0.009	−0.051***
	(0.243)	(0.084)	(0.051)	(0.011)
N	146,562	808,981	97,374	808,659
R^2	0.642	0.548	0.529	0.318

Panel C: Control-Function IV Estimation

	(1) 1st stage: Zombie	(2) 2nd stage: ROA (%)	(3) 2nd stage: Sales gr.
Lending rate	0.0093***		
	(0.0009)		
Zombie dummy (ICR)		−24.441***	−1.366**
		(4.822)	(0.664)
Residual from 1st stage		21.743***	1.307**
		(4.822)	(0.664)
Implied structural effect		−2.698	−0.059
N	1,560,529	972,634	931,971
R^2	0.083	0.513	0.301

Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Panel A reports robustness checks excluding persistent zombies (columns 1–2) and transition-window event studies (columns 3–8). Panel B splits the sample at 2013. Panel C reports control-function IV estimates using the lagged country-level lending rate as instrument; the implied structural effect is the sum of the zombie dummy and residual coefficients. The zombie dummy is measured contemporaneously; all control variables are lagged one year. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A7: Zombie Status and Firm Productivity (Within-Firm Estimates)

	(1) Log labour productivity	(2) Log value-added productivity
Zombie dummy (ICR)	−0.089***	−0.156***
	(0.007)	(0.012)
Log size	0.140***	0.092***
	(0.006)	(0.009)
Leverage	−0.046**	−0.110***
	(0.019)	(0.024)
Tangible asset	−0.352***	−0.239***
	(0.017)	(0.025)
Capex ratio	0.001***	0.001***
	(0.000)	(0.000)
Observations	232,838	135,916
Firm FE	Yes	Yes
Country×Year FE	Yes	Yes

Notes: This table reports the within-firm estimates of the effect of zombie status on firm productivity, following the specification of Table 5 (firm and country×year fixed effects, with lagged controls for log size, leverage, tangibility, and the capital expenditure ratio). Labour productivity is log real sales per employee; value-added productivity is log of (sales − material costs) per employee. The key regressor is the contemporaneous zombie dummy (ICR definition), so the coefficient is identified from firms that transition into or out of zombie status. Coefficients are approximately log points, so −0.089 and −0.156 correspond to about −8.5% and −14%. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A8: Supply-Side Evidence: Zombie Status and Asset Turnover

	(1) Sales/TA All firms	(2) Sales/TA Manufacturing
Zombie dummy (ICR)	−0.039***	−0.037***
	(0.005)	(0.006)
Leverage	−0.129***	−0.159***
	(0.011)	(0.014)
Log size	−0.196***	−0.201***
	(0.005)	(0.006)
Tangible asset	−0.469***	−0.431***
	(0.011)	(0.014)
Capex ratio	−0.000*	−0.001***
	(0.000)	(0.000)
Observations	1,219,391	534,120
R^2	0.827	0.799
Firm FE	Yes	Yes
Country×Year FE	Yes	Yes

Notes: The dependent variable is asset turnover (Sales/Total Assets), a proxy for revenue productivity and markup. Column 1 uses the full sample; column 2 restricts the sample to manufacturing firms (SIC 20–39). The zombie dummy is measured contemporaneously; all control variables are lagged one year. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A9: Zombie Status and Firm Markups (Within-Firm Estimates)

	(1) Gross margin	(2) Value-added margin	(3) Operating margin	(4) DLW log markup
Zombie dummy (ICR)	−0.021***	−0.022***	−0.069***	−0.024***
	(0.001)	(0.002)	(0.002)	(0.003)
Log size	−0.021***	−0.010***	−0.002*	−0.015***
	(0.001)	(0.001)	(0.001)	(0.002)
Leverage	0.014***	0.007***	−0.002	0.019***
	(0.003)	(0.003)	(0.004)	(0.005)
Tangible asset	0.034***	0.017***	−0.013***	0.028***
	(0.003)	(0.003)	(0.003)	(0.005)
Capex ratio	0.000**	0.000	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	438,427	349,582	529,789	349,252
Firm FE	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes

Notes: This table reports the within-firm estimates of the effect of zombie status on firm markups and margins, following the specification of Table 5 (firm and country×year fixed effects, with lagged controls for log size, leverage, tangibility, and the capital expenditure ratio). Each column is a separate regression. Gross margin = gross profit/sales; value-added margin = (sales − material costs)/sales; operating margin = EBIT/sales; the DLW log markup is the log production-approach markup of De Loecker and Warzynski (2012), $\mu_{it} = \theta_s^M/(\text{materials/sales})$, with the output elasticity θ_s^M estimated per SIC 2-digit industry. The operating margin is partly mechanical because EBIT enters the ICR-based zombie definition, so the gross and value-added margins are the cleaner underpricing proxies. Standard errors clustered at the firm level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A10: Zombie Spillovers to Advanced Economies via GVC : Annual Data

	(1)	(2)	(3)	(4)
	Inflation		Real GDP growth	
SpilloverIndex_Trade	0.049		−1.270**	
	(0.207)		(0.457)	
SpilloverIndex_Import		0.278		−1.398**
		(0.241)		(0.623)
Unemployment rate	−0.081***	−0.083***		
	(0.024)	(0.024)		
Commodity price change	0.061*	0.059*		
	(0.031)	(0.031)		
Inflation	0.359***	0.352***		
	(0.034)	(0.034)		
GFCF/GDP			0.189	0.183
			(0.117)	(0.117)
Credit-to-GDP			0.011	0.011
			(0.008)	(0.008)
Population growth			−1.037	−0.980
			(0.745)	(0.747)
Real GDP growth			0.128*	0.129*
			(0.067)	(0.067)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	406	406	308	308
R^2	0.693	0.693	0.683	0.683

Notes: The same specification as in Table 8 but using annual data. All control variables are expressed in percentage terms. All explanatory variables are lagged one period. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A11: Zombie Spillovers via GVC: Interaction Specification

	(1)	(2)	(3)	(4)
	Inflation		Real GDP growth	
ZombieShare_Asia × Trade exposure	−0.065**		−0.242***	
	(0.025)		(0.046)	
ZombieShare_Asia × Import exposure		−0.055*		−0.242***
		(0.031)		(0.065)
Unemployment rate	−0.025**	−0.025**		
	(0.011)	(0.010)		
Commodity price change	−0.004	−0.004		
	(0.027)	(0.027)		
Inflation	0.799***	0.800***		
	(0.016)	(0.016)		
GFCF/GDP			0.051***	0.051***
			(0.015)	(0.015)
Credit-to-GDP			0.006	0.006
			(0.004)	(0.005)
Population growth			0.092	0.108
			(0.241)	(0.244)
Real GDP growth			0.643***	0.644***
			(0.037)	(0.037)
Country FE	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes
Observations	1,561	1,561	1,188	1,188
R^2	0.892	0.892	0.812	0.812

Notes: The key regressor is the interaction between country j's trade (import) exposure to Asia and the aggregate Asian zombie share, both lagged one quarter. The constituent variables in the interaction terms are absorbed by fixed effects. All control variables are expressed in percentage terms. All explanatory variables are lagged one period. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A12: Supply vs. Demand: Advanced-Economy Import Value from Asia and the Zombie Spillover Index

	(1)	(2)	(3)
	Log AE imports from Asia-10		
Panel A: Trade-weighted spillover index			
SpilloverIndex_Trade (std)	−0.038	−0.024	0.046
	(0.032)	(0.033)	(0.049)
AE real GDP growth	0.017**	0.010	0.023***
	(0.006)	(0.007)	(0.004)
Unemployment rate		−0.037***	
		(0.009)	
Commodity price change		0.006	
		(0.007)	
Panel B: Import-weighted spillover index			
SpilloverIndex_Import (std)	−0.093	−0.077	0.015
	(0.084)	(0.079)	(0.061)
AE real GDP growth	0.015**	0.008	0.024***
	(0.007)	(0.007)	(0.004)
Unemployment rate		−0.035***	
		(0.008)	
Commodity price change		0.005	
		(0.006)	
Observations	406	406	406
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	No

Notes: The dependent variable is log advanced-economy nominal imports of goods from the ten Asian EMEs (IMF Direction of Trade Statistics, annual, on a Cost, Insurance, and Freight (CIF) basis). The zombie spillover index is the standardized trade-weighted index of Table 8 in Panel A and its import-weighted counterpart in Panel B. All columns control for advanced-economy real GDP growth; column 2 adds the unemployment rate and the commodity import price change; column 3 drops year fixed effects. A demand contraction would lower import value, whereas under both weightings the spillover does not—and is positive once the common time trend is admitted—while GDP growth raises import value, confirming the specification detects demand. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A13: Zombie GVC Spillover and Advanced-Economy Producer Prices (PMI)

	(1)	(2)	(3)	(4)
	Trade-weighted		Import-weighted	
	Input price	Output price	Input price	Output price
SpilloverIndex_Trade (std)	−1.131***	−0.622***		
	(0.323)	(0.092)		
SpilloverIndex_Import (std)			−0.906**	−0.384**
			(0.311)	(0.163)
Unemployment rate	−0.014	−0.019	−0.018	−0.016
	(0.059)	(0.023)	(0.059)	(0.021)
Commodity price change	0.506	0.471**	0.509	0.477**
	(0.528)	(0.208)	(0.538)	(0.211)
Output gap	−0.155**	−0.004	−0.156**	−0.005
	(0.069)	(0.040)	(0.070)	(0.041)
Lagged dependent variable	0.648***	0.713***	0.654***	0.726***
	(0.047)	(0.053)	(0.050)	(0.058)
Country FE	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes
Observations	763	584	763	584

Notes: The dependent variable is the S&P Global PMI manufacturing input-price (columns 1 and 3) or output-charge / selling-price (columns 2 and 4) diffusion index, a quarterly average of the monthly index (whole-economy survey for Hong Kong SAR and Singapore, which lack a manufacturing survey). A diffusion index is bounded in $[0, 100]$ with 50 = no change; a higher reading denotes faster price increases, so a negative coefficient means the spillover *softens* producer-price inflation. The regressor is the Asian zombie spillover index—trade-weighted in columns 1–2, import-weighted in columns 3–4—standardized within the 2008Q3–2021Q4 estimation sample as in Table 8; the sample is the country-quarters for which the PMI price series are available (the surveys begin in the 2010s for most economies). All columns include the Table 8 controls (lagged unemployment rate, commodity import price change, output gap) and the lagged dependent variable; both weightings deliver a significant disinflationary effect on producer prices. For comparison, re-estimating the same specification with CPI inflation as the dependent variable on the identical sample yields a coefficient of only −0.09 (s.e. 0.05, insignificant). Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A14: Domestic Producer Prices and Own Zombie Share (Asian EMEs, PMI)

	(1)	(2)	(3)	(4)
	PMI output (selling) price		PMI input price	
Own zombie share (%, lagged)	−0.137**	−0.100*	−0.218***	−0.185*
	(0.047)	(0.047)	(0.064)	(0.081)
Unemployment rate		−0.299		−0.652
		(0.325)		(0.427)
Commodity price change		0.034		0.033
		(0.087)		(0.151)
Country FE	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes
Observations	428	375	428	375

Notes: Quarterly panel of the 10 Asian EMEs, 2008–2021. The dependent variable is the S&P Global PMI manufacturing output-charge / selling-price (columns 1–2) or input-price (columns 3–4) diffusion index (whole-economy survey for Hong Kong SAR and Singapore). The regressor is the economy's own one-quarter-lagged asset-weighted (ICR) zombie share in percent. A diffusion index is bounded in $[0, 100]$ with 50 = no change, so a negative coefficient means a higher own zombie share softens domestic producer-price inflation—the producer-price analogue of the own-economy CPI result in Table 7. The two specifications follow columns 1 and 2 of Table 7: the odd columns include no controls, the even columns add the lagged national unemployment rate and commodity import price change. The controlled columns drop to nine economies because Chinese Taipei lacks the national unemployment series over the PMI window. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A15: Which Expenditure Component Drives the Advanced-Economy GDP Decline?

Dependent variable: contribution to real GDP growth of...	Coef. on spillover index
Investment (gross fixed capital formation)	−0.658
	(0.409)
Private consumption	−0.280*
	(0.155)
Government consumption	0.071
	(0.083)
Net exports	0.423
	(0.584)
Memo: total GDP growth (IMF)	−0.434***
	(0.095)

Notes: Each row is a *separate* regression of one expenditure component's contribution to real GDP growth on the standardized trade-weighted GVC zombie spillover index of Table 8; the components never enter as each other's regressors. Contributions are year-on-year, $(X_t - X_{t-4})/\text{GDP}_{t-4}$, so seasonality cancels and no seasonal adjustment is needed; they are built from IMF Quarterly National Economic Accounts constant-price series for the 28 advanced economies with available data (Canada excluded). Controls, fixed effects (country and year-quarter), sample (2008Q3–2021Q4), and country-clustered standard errors follow the baseline Table 8 exactly. The IMF data-based total GDP coefficient (−0.434) is in line with the headline cross-border GDP result, and the four component contributions plus inventories sum to it (identity correlation 0.90). The GDP decline is concentrated in investment; government spending, consumption and net exports either contribute less or do not contribute. Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A16: Country-Industry Refinement of the Cross-Border Spillover (Annual)

	Sector-export-weighted		Aggregate (baseline)	
	(1) CPI	(2) GDP	(3) CPI	(4) GDP
Zombie spillover index (std)	−0.145**	−0.546**	−0.186*	−1.013***
	(0.066)	(0.231)	(0.093)	(0.280)
Unemployment rate	−0.036		−0.043	
	(0.025)		(0.030)	
Commodity price change	0.157		0.187	
	(0.215)		(0.157)	
Output gap	0.110*		0.065*	
	(0.060)		(0.036)	
Inflation	0.351***		0.194***	
	(0.040)		(0.055)	
GFCF/GDP		0.124		0.143
		(0.140)		(0.127)
Credit-to-GDP		0.001		0.006
		(0.008)		(0.007)
Population growth		−1.133		−0.835
		(0.663)		(0.634)
Real GDP growth		0.115		0.077
		(0.078)		(0.068)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	286	260	377	286
Adj. R^2	0.654	0.649	0.619	0.656

Notes: Annual panel of advanced economies, 2008–2021. Columns 1–2 use a *country-industry* refinement of the cross-border spillover index: for advanced economy j, $\left[\sum_{i,s} X_{i,s\to j} \times \text{ZombieShare}_{i,s,t-1}\right]/\text{TotalImports}_j$, where i indexes the nine Asian source economies reported in UN Comtrade (excluding Chinese Taipei), s the 20 manufacturing industries (SIC 2-digit, built by aggregating roughly 1,100 UN Comtrade HS 4-digit product lines via an HS-chapter-to-SIC concordance), $X_{i,s\to j}$ the pre-determined 2018–2019 average exports of industry s from i to j, $\text{ZombieShare}_{i,s,t-1}$ the one-year-lagged asset-weighted (ICR) zombie share, and TotalImports_j advanced economy j's total imports (the same denominator as Table 8). Columns 3–4 re-estimate the aggregate trade-weighted index of Table 8 at the same annual frequency as a matched reference. The index is intrinsically annual—its variation comes from the annual zombie share, the weights being fixed—so the regressions are run at annual frequency; both indices are standardized within the estimation sample. The control set, lag structure, and fixed effects follow Table 8. The export weights are fixed at their 2018–2019 average—the earliest years for which we have the UN Comtrade HS 4-digit micro-data—rather than the 2005–2007 pre-sample base used for the aggregate index. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A17: Robustness of the Spillover Results to the Weight Base Year

DV / SpilloverIndex	(1) 2005–07 (baseline)	(2) 2019–20 (recent)	(3) Rolling $(t-1, t-2)$
CPI / Trade-weighted	−0.134***	−0.106***	−0.082*
	(0.036)	(0.036)	(0.043)
CPI / Import-weighted	−0.089**	−0.090**	−0.080**
	(0.034)	(0.037)	(0.032)
GDP / Trade-weighted	−0.407***	−0.324***	−0.341***
	(0.096)	(0.068)	(0.083)
GDP / Import-weighted	−0.424***	−0.317***	−0.335***
	(0.109)	(0.080)	(0.097)
Controls	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes
R^2 (CPI / GDP)	0.89 / 0.81	0.89 / 0.81	0.89 / 0.81
Observations (CPI / GDP)	1,561 / 1,188	1,561 / 1,188	1,561 / 1,188

Notes: Each cell is the spillover-index coefficient from a separate re-estimation of the Table 8 specification (identical sample, controls, fixed effects, and clustering), changing only the bilateral weights used to construct the spillover index. Column 1 uses the pre-determined 2005–07 average weights (reproducing the Table 8 baseline up to the index reconstruction); column 2 uses recent (2019–20) trade weights; column 3 uses a rolling two-year window (the average of years $t-1$ and $t-2$, predetermined relative to each observation). The per-economy quarterly zombie shares are held fixed throughout; only the weights vary. The signs and (with the marginal exception of the rolling trade-weighted CPI coefficient) the significance of all four estimates are preserved across weighting schemes. Standard errors clustered at the country level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A18: China's Zombie Prevalence and Non-China Asian Firms (Shift-Share Exposure)

	(1) Gross margin	(2) Gross margin (non-zombie)	(3) Log labor productivity	(4) ROA
China-zombie exposure	−0.129**	−0.168**	−0.467	−6.360
	(0.061)	(0.071)	(0.994)	(3.962)
Own zombie share	−0.019**	−0.022**	−0.045	−0.254
	(0.009)	(0.009)	(0.066)	(0.497)
Log size	−0.021***	−0.016***	0.155***	−2.806***
	(0.002)	(0.001)	(0.007)	(0.259)
Leverage	0.011***	0.003	−0.083***	0.227
	(0.004)	(0.002)	(0.014)	(0.304)
Tangible asset	0.032***	0.035***	−0.326***	−1.277***
	(0.005)	(0.005)	(0.024)	(0.301)
Capex ratio	0.000***	0.000*	0.001***	0.001
	(0.000)	(0.000)	(0.000)	(0.002)
Firm FE	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes
Sector×Year FE	Yes	Yes	Yes	Yes
Observations	407,433	362,414	199,536	411,106

Notes: Sample: manufacturing firms (SIC 20–39) in the eight non-China Asian economies for which the China import share is available (Chinese Taipei is absent from UN Comtrade). The regressor, "China-zombie exposure," is a shift-share (Bartik) term equal to the economy's pre-determined (2005–07) China share of Asian-sourced imports times China's asset-weighted zombie share in the firm's SIC 2-digit sector and year. Column 2 restricts to firms that are not themselves zombies. All columns include firm, country×year, and sector×year fixed effects—so the coefficient is identified purely from differential China exposure across economies within a sector-year—together with the firm controls of Table 5 (lagged log size, leverage, tangibility, and capex ratio) and the firm's own country–sector zombie share. Standard errors clustered at the country×sector level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.