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The Global (Mis)Allocation of Capital*

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Abstract

This paper studies the efficiency of international capital flows into and out of the U.S. using security-level equity holdings matched to firm-level measures of economic performance from 1995 to 2022. We find that both US and foreign investors tilt their international equity portfolio toward the top of the firm distributions of Total Factor Productivity (TFP), markups, Marginal Revenue Product of Capital (MRPK) and intangible capital. This allocation to the top occurs primarily through a between-firm component. For US firms with high initial productivity, and for foreign firms with high MRPK, increases in international investors' equity holdings are associated with higher future investment in the near term.

JEL Classification: E2, F3, F6.
Keywords: productivity, capital allocation, capital flows.

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1. Introduction

At the aggregate level, whether international capital flows are directed toward countries with the highest marginal return to capital – usually associated with higher productivity or growth potential is a longstanding issue (see Lucas (1990), Caselli and Feyer (2007), Gourinchas and Jeanne (2013), among others). Answers to this question have been elusive in part because net aggregate capital flows cover different types of cross-border flows (for instance, portfolio vs. direct investment vs. bank loans, public vs. private) whose determinants might differ (see Aguiar and Amador (2011), Alfaro et al. (2008), among others). Moreover, precise measures of a country's aggregate productivity are hard to obtain or interpret. For instance, it is by now well-established that misallocation of resources across firms is a key determinant of economic performance between countries (see Restuccia and Rogerson (2008) or Hsieh and Klenow (2009), among others).

This paper links these two observations by asking how international capital flows allocate capital *across firms within a country*, rather than simply across countries. To do so, we exploit access to a large confidential dataset of the universe of US securities held by foreigners and foreign securities held by US investors and match these holdings to firm-level estimates of economic performance. Our main result is that international investors (whether US investors in the rest of the world or foreign investors in the US) allocate their portfolio toward the top of the firms' distribution, within countries, within regions and within sectors. We also find that for US firms with high initial productivity, and for foreign firms with high MRPK, increases in net cross-border equity holdings are associated with higher future investment. Our results provide insights into the role of international investors in improving allocative efficiency.

The backbone of our analysis is the confidential, security-level dataset of US cross-border equity holdings from the official filings of custodians and investors through the Treasury International Capital (TIC) system, which can be mapped to individual firms.[1] These data have been collected annually since 2003 and less frequently for earlier years.

The second pillar of our analysis consists of structurally estimated, firm-level measures of

1 Reporters are legally-mandated to complete the TIC SHL/SHLA surveys. More details on the data are provided in Appendix A.

production efficiency and financial conditions using accounting (Compustat Global) and financial (Refinitiv or Worldscope) data. We estimate firm-level revenue productivity (TFPR) and regional production elasticities following the methodology of Olley and Pakes (1996). We supplement this measure with the estimates of marginal revenue product of capital (MRPK) and firm-level markups following the methodology of De Loecker and Warzynski (2012). We proxy firms' credit frictions through the Merton (1974) 'distance to default' measures and compute measures of intangible capital through perpetual inventory methods.[2] We then merge our firm-level measures with US cross-border investment through an ISIN matching process. Our final dataset spans 1995 to 2022 and covers roughly 21,000 US and 50,000 foreign firms.

Our main goal is to assess how capital flows are allocated along the firms' productivity and efficiency distribution and to evaluate the impact of these equity flows on firms' capital investment and growth.

We start by documenting some stylized facts. First, we find that there is significant dispersion in some of the key firm-level measures, such as mark-ups, in our sample and that this dispersion, a finding often interpreted as evidence of misallocation (see Hsieh and Klenow (2009)), increases over time.[3] Second, we find a significant tilt in the portfolio weighted distributions of mark-ups toward the upper tails, suggesting a tendency either for wedges to grow at the top or for the shares to be increasingly allocated to the top.

Next, we assess more formally the allocative role of international capital flows. To do so, we start by defining the firm's net international portfolio share (NIPS) as the share of that firm in international investors' portfolio minus the share of that firm in the country's market capitalization. If international investors allocate their shares according to each firm's market cap - that is, if they hold the market - then the NIPS for all firms is equal to zero. If a firm is overweight in international investors' portfolios, then its NIPS is positive. Conversely, if a firm is underweight in international investors' portfolios, then its NIPS is negative. We then estimate the relationship

2 Merton's distance-to-default measure is a good indicator of the cost of external finance under various contract structures.

3 Some of the dispersion in firm-level measures may also indicate measurement error, adjustment costs or misspecification.

between each firms' NIPS firm-level measures of economic performance, controlling for region, sector and time fixed effects. A positive relationship between NIPS and firm-level performance indicates that international investors allocated their portfolio towards the top of the firm-level distribution within region, sector and year. A positive relation indicates that capital flows are allocated to firms at the top of the distribution. Allocating more capital towards firms with higher productivity, higher MRPK or higher markups (suggesting that the firm's size is inefficiently low) can all improve allocative efficiency (see Hsieh and Klenow (2009) or Baqaee and Farhi (2020)).

We find that foreign investors tilt their portfolios toward US firms with relatively high TFPR and intangible capital, but also toward firms with mark-ups. In the other direction, US investors weight their portfolios, within regions, toward foreign firms with relatively high MRPK as well as high credit risk (low distance to default). When we examine the allocation of their portfolio shares globally we find that foreign investors weight their portfolios also toward firms with high productivity and intangible capital. In either case, the allocation to the top potentially fosters growth, either by allocating funds to the most productive firms or by facilitating the growth of firms with high wedges. The magnitudes of the effects are economically meaningful. For instance for US firms, a 1 standard deviation increase in mark-ups is associated with more than one standard deviation increase in the NIPS, and corresponds roughly to a move from the 25th to the 75th percentile of the NIPS distribution.[4] For foreign firms, a 1 standard deviation increase in TFPR is associated with almost a one standard deviation increase in the NIPS, and corresponds to a move from the median to the 90th percentile of the NIPS distribution.[5]

The significance of the production efficiency and wedge measures persists even when we include financial indicators such as Sharpe ratios, when controlling for size, or when changing the sector specification of the production function estimation.[6,7]

4 A 1 standard deviation increase in markup is a 0.0063 increase in the NIPS. The standard deviation of NIPS is 0.055. for liabilities.

5 A 1 standard deviation increase in TFPR corresponds to a 0.0505 increase in the NIPS when scaled by total holdings in Table 5. The standard deviation of this NIPS measure is 0.066.

6 The informativeness of TFPR and other production measures, beyond size and other financial indicators, is in line with a large literature that explain residual dispersions with management practices (Bloom and Van Reenen (2007)), blueprints and efficient allocation of ideas (Jones (2013)).

7 We also run our multivariate specifications. Results are similar. Our preferred specification is the univariate one

Next, we unpack the drivers of this reallocation to the top through a dynamic decomposition of the changes in aggregate MRPK, mark-ups, and TFPR, weighted by equity shares, into the within- and between firm components (see Olley and Pakes (1996)). This decomposition allows us to assess whether firms that received more funding increased their mark-ups and MRPK over time or whether funding was reallocated toward firms at the top. We find that the between-firm component is dominant in the reallocation process, as international investors relocate their shares over time toward firms with higher MRPK, mark-ups, and TFPR. The dominance of the between-firm reallocation, and its rise over time, have been documented in other contexts, but the link to capital inflows is novel.

Finally, we attempt to assess whether the tilt in international investors' portfolios toward the top is associated with increased investment. This would provide direct evidence that international capital flows do help improve allocative efficiency by increasing the size of the more productive firms. To answer this question, we estimate a specification linking the (log) change in tangible investment one, two or four years ahead to the change in the NIPS, interacted with a dummy capturing whether the firm TFPR or MRPK are above the median.[8] We find a mildly significant increase in capital expenditures for US firms whose productivity is above the median, and a more significant increase for foreign firms whose MRPK is above the median, at the one year horizon. However, at longer horizons there is disinvestment from foreign firms. These last results should be interpreted with caution. A small but growing literature, which we survey below, studies the link between capital flows and misallocation. These papers typically exploit a well-identified and plausibly exogenous event for a single country - such as a financial liberalization resulting in large capital inflows whose effect can be tracked. While our paper provides a direct link between highly disaggregated international securities and firms' measures of allocative efficiency across a broad range of countries, we do not have a comparable exogenous variation in the drivers of portfolio shares.

as it avoids the risk of multicollinearity. Our goal is to measure the additional marginal contribution of those measures.

8 The regression controls for the past capital, the change in the net share alone and the sector fixed effects, besides the main effects of the interaction term. For claims the regression also includes the region fixed effects.

Our findings contribute to several strands of the literature. First, we provide evidence that allocation of capital across firms within a country can help improve allocative efficiency, contributing to the misallocation literature (see Restuccia and Rogerson (2008), Hsieh and Klenow (2009) or Baqaee and Farhi (2020), among others). The direct matching of securities and firm measures is pivotal for this. Our results on the reallocation to the most productive firms also speak to the growing evidence on the importance of superstar firms for the macroeconomy (see Autor et al. (2020)).

Second, our results add to a growing literature that connects capital flows to misallocation. Past literature exploits episodes of large capital inflows and focuses on specific countries, with very different results. Gopinath et al. (2017) documents a significant increase in the dispersion of the returns to capital across firms and a significant increase in productivity losses from capital misallocation during the period of large capital inflows in Spain.[9] Contrary to these results, Varela (2018) use census data from Hungary and show instead that the opening of international financial markets significantly benefited firms. Bau and Matray (2023) find a similar result for India and for firms whose MRPK was above the median prior to the opening of the financial markets. Finally, Cingano and Hassan (2022) studies the role of capital flows through bank funding for Italian firms and their MRPK. Relative to this literature, our paper exploits a direct matching between international securities and firms' efficiency measures. The large role of US securities in the international financial network also allows us to reach broader conclusions about the allocative role of capital flows. We also consider a broad spectrum of misallocation measures, capturing frictions in product or financial markets.

Third, the early literature on capital flows (Lucas (1990)) argued that capital was not flowing from rich to poor countries, despite substantial differences in the marginal return to capital. Subsequent literature emphasized the importance of wedges on domestic investment and savings in stifling returns (Gourinchas and Jeanne (2013); Caselli and Feyer (2007)), or the role of public versus private assets (Aguiar and Amador (2011); Alfaro et al. (2008)). One hurdle in measuring the

9 Some theoretical papers provide arguments for the links between capital flows, misallocation and efficiency. Mendoza (2010) linked it to heterogeneity in access to credit and Benigno et al. (2025) to a sectoral shift of resources toward the least productive consumption sector.

allocation of capital flows across countries is the difficulty in measuring productivity and wedges precisely at the country level. Our study overcomes this hurdle by shifting the focus from countries to firms. Our finding of a capital allocation to the top of the firms' distribution, even within regions, resolves previous discrepancies.

Finally, our paper contributes methodologically to the growing literature that estimates firms' measures structurally (most of it cited above or below in the description of the methodologies), as we extend the proxy method by computing regional production elasticities.[10]

2. Econometric Strategy and Data

Our analysis matches US cross-border equity holdings with firm productivity and other measures with three main goals. The first is to examine the allocation of international funding along with the distribution of each firm measure. The second is to decompose changes in allocation between changes in the individual wedges and changes in the share of firms at each wedge percentile. The third is to assess how firm investment responds to international capital flows. Below, we first describe the data, then the econometric specifications, and then briefly introduce our estimates of the firm measures. More details on data and firm measures are in Appendices A and B.

2.1. Data

For our analysis, we compile and match two micro datasets. The first consists of a high-quality, confidential, security-level dataset of the universe of US external portfolio claims and liabilities. This is constructed from the official filings of custodians and investors through the US Treasury International Capital (TIC) system, collected annually since 2003, and less regularly in earlier years. The filings include the quantity of each foreign security held by a US investor and US security held by a foreign investor, as well as information on their returns.[11] Our analysis focuses on equities, as we can map them to individual firms. More details on the dataset are in Appendix A. For country

10 See Appendix B.

11 Bertaut et al. (2024) compile and use the same data to re-examine the size of the US excess return on external claims versus liabilities and to decompose its components by asset class.

grouping we use firm nationality rather than residence – that is, the nationality of the parent holding company of the issuing firm – using the mapping provided in Bertaut et al. (2021) .

The second pillar of our analysis is a dataset of firm-level productivity and other measures of allocative wedges. Specifically, we estimate Olley and Pakes (1996) measure of revenue productivity (TFPR henceforth), marginal revenue product of capital (MRPK henceforth), markups, intangible capital, and Merton (1974) distance to default.[12] To construct these measures, we use structural estimations based on accounting data from Compustat Global) and financial data from Refinitiv.[13] Accounting data were used to estimate production elasticities, mark-ups, and intangibility. Financial data were used to estimate distance to default and Sharpe ratios. We obtain the equity market capitalization of each firm from Worldscope. More details on how we estimate each firm-level measure are provided in Section 2.3 and Appendix B.

We merge the two datasets with the following steps. The TIC equities are matched to the Worldscope identifiers, which are then matched to the identifiers from all our firm measures.[14] When we divide the securities by sector, we use the Worldscope General Industry Classification. Estimates of the production function are done based on this classification and for robustness also based on 2-digit NAICS. Our final combined dataset covers the time period 1995-2022 and has roughly 21,000 observations for US firms and close to 50,000 observations for foreign firms. We are able to match most of the TIC data with the corresponding firm measures from Compustat Global data. The share matched on average for all the years in our sample is 80% for US firms and 70% for foreign firms.

2.2. Empirical Specifications

We start by relating the cross-border equity holdings to the firm-level measures. Our goal is twofold. First, we aim to detect drivers of differences between the observed allocations and those of a

12 We estimate TFPR using both revenues and value added, and results are robust to both.

13 Compustat Global data has the best match with the TIC securities data. Compustat Global data were obtained by Ester Faia under the purview of Goethe University Frankfurt. The remaining co-authors, Carol Bertaut, Stephanie Curcuru and Pierre-Olivier Gourinchas did not have any unauthorized access to this data while working on this paper/project.

14 In some cases, this implies a further cross-walk from Compustat to Worldscope identifiers.

simple allocation based on market capitalization. In other words, we aim to capture the motives of the allocation above and beyond aggregate market capitalization. Second, we aim to detect the allocation of portfolios along the firms' distribution within countries, and hence independently of institutional settings, and within sectors. Given this background, our baseline specification is as follows.

Consider a firm i and denote $w_{i,t}$ the dollar holdings of firm i's security in international portfolios in year t. If i is a US firm, $w_{i,t}$ denotes the dollar holdings by foreign investors, while if i is a foreign firm, $w_{i,t}$ denotes the dollar holdings by US investors. Denote $W_t = \sum_i w_{i,t}$ the total dollar value of the international portfolio in year t, summing over all internationally held securities, and $W_{r,t} = \sum_{i \in r} w_{i,t}$ the total dollar value of the international portfolio invested in region r at time t where a region could be a country, or group of countries.[15] The international portfolio share of firm i in region r is then $s_{i,r,t} = w_{i,t}/W_{r,t}$. A natural benchmark for this portfolio share is the market share of firm i in region r, defined as the ratio of firm i's market capitalization $v_{i,t}$ to the total market capitalization of region r, $V_{r,t}$: $\bar{s}_{i,r,t} = v_{i,t}/V_{r,t}$. Accordingly, we define the Net International Portfolio Share (NIPS) as the difference between the international portfolio share and the market capitalization benchmark:

$$NIPS_{i,r,t} \equiv s_{i,r,t} - \bar{s}_{i,r,t} = \frac{w_{i,t}}{W_{r,t}} - \frac{v_{i,t}}{V_{r,t}}. \tag{1}$$

If international investors allocate their portfolios according to the market benchmark in region r, then $s_{i,r,t} = \bar{s}_{i,r,t}$ and $NIPS_{i,r,t} = 0$. If a firm is overweight in international investors' portfolios, then its NIPS is positive. Conversely, if a firm is underweight in international investors' portfolios, then its NIPS is negative.

Equation (1) defines the net share within region. We also consider an alternative definition, where

15 Assignment is by nationality, based on MSCI code. We define regions as follows: all other EMEs, which include Eastern Europe, Latin America, Africa; Asian EMEs; Core euro area, which includes Austria, Belgium, France, Germany, Netherlands; Other Europe, excluding eastern Europe, the UK, Switzerland, Scandinavia; other advanced economies, which includes Australia, New Zealand, Canada, Japan; UK and channel islands.

the portfolio share is net of the firm's market cap in the global portfolio. The expression reads as follows:

$$NIPS_{i,t} \equiv s_{i,t} - \bar{s}_{i,t} = \frac{w_{i,t}}{W_t} - \frac{v_{i,t}}{V_t}. \tag{2}$$

where $W_t = \sum_r W_{r,t}$ and $V_t = \sum_r V_{r,t}$. We discuss below what the two alternatives imply in terms of interpretation.

Baseline Regression. The baseline specification links the net share of security i to the firm measures:

$$NIPS_{i,r,t} = \gamma + f_r + f_t + \alpha^j x^j_{i,t} + \epsilon_{i,t} \tag{3}$$

where $x^j_{i,t}$ is one of the economic performance measures j, for firm i at time t. The specification includes region fixed effects, f_r: the goal is to measure allocation along the firm distribution, even within regions. We include time fixed effects to purge for changes in the allocation due to time-varying factors. In robustness checks, we also include sector fixed effects, therefore obtaining the allocation of capital between firms and within sectors. The firm measures used as regressors are Olley and Pakes (1996)'s revenue productivity, MRPK, markups, intangible capital, and distance to default.[16] We run our baseline in a univariate mode to avoid multicollinearity. However, the coefficients and their significance are basically unmodified if we run it in a multivariate mode.

The baseline specification, which uses portfolio shares within regions, shows how investors allocated their portfolio shares to each firm based on its observed characteristics, even within regions, sectors and across time. The coefficients of interest are the α^j. A positive coefficient indicates that investors allocate shares to firms located at the top of the corresponding distribution of that specific firm measure, beyond the share that they would allocate based on market capitalization. In the alternative case in which the net share is defined relative to the market cap in the global portfolio the coefficient of interest captures the overall allocation across firms' characteristics, independently of the region.

16 The baseline estimation for Olley and Pakes (1996) production function is done using a sector selection that conforms with the TIC data. Our results remain robust to variants based on other sector selection.

The regression is estimated on all equity holdings and time periods, separately on equity holdings of US and foreign firms. Estimation is done with robust standard errors, clustered at the firm level.

Within-Between Firms Decomposition. One way to assess the macroeconomic implications is to aggregate the firm measures, weighted by their shares in the cross-border portfolio, and decompose changes over time into within- and between- firm components. If, for instance, the changes in an aggregate productivity measure are driven primarily by the between-firm component, this implies that investors reallocate over time their investment toward firms with higher productivity. If instead, aggregate productivity increases, but the within component is predominant, this means that investors keep funding in the same firms, whose productivity grows over time. In sum, we can assess how much of the change in the aggregate measure over time is due to the contribution of changes in each firm's measure, or to the reallocation of investors' portfolios.

We aggregate each firm's productivity, and other measures, by weighting each individual firm measure by the net share defined earlier:

$$FM^j_{r,t} = \sum_i NIPS_{i,r,t} x^j_{i,r,t} \tag{4}$$

where $x^j_{i,t}$ is the firm measure j. We then decompose changes in the aggregate into within and between components:

$$\begin{aligned} FM^j_{r,t} - FM^j_{r,t-1} &= \sum_i NIPS_{i,r,t} x^j_{i,t} - \sum_i NIPS_{i,r,t-1} x^j_{i,t-1} = \\ &= \underbrace{\sum_i NIPS_{i,r,t-1}(x^j_{i,t} - x^j_{i,t-1})}_{\text{within term}} + \underbrace{\sum_i (NIPS_{i,r,t} - NIPS_{i,r,t-1}) x^j_{i,t-1}}_{\text{between term}} + \\ &+ \underbrace{\sum_i (NIPS_{i,r,t} - NIPS_{i,r,t-1})(x^j_{i,t} - x^j_{i,t-1})}_{\text{covariance}} \end{aligned} \tag{5}$$

Future Growth Prospects. To examine the real effects of international capital flows, we use a state-contingent econometric specification that allows us to examine whether firms respond to increased international holdings by scaling up their capital investment. To address this question, we estimate a firm-level regression linking the future changes in capital investment expenditures, either tangible or intangible, to the change in NIPS interacted with a dummy that captures whether firms' MRPK, mark-up or TFPR are above the median. To examine the predetermined impact of international funding, we repeat the regression with one, two, or four years ahead projections. We control for past investment to purge for trends. Further, we control for sector fixed effects in liabilities (US firms) and for both sector and region fixed effects in claims (foreign firms). If capital flows from international investors help improve allocative efficiency, we expect to see an increase in capital investment expenditures for those whose NIPS is increasing. Formally, the specification reads as follows:

$$\Delta \log(k_{i,t+n}) = \alpha^n + \beta^n \Delta NIPS_{i,r,t} \mathcal{I}^{X_{i,t}} + \gamma^n \Delta NIPS_{i,r,t} + \phi^n \mathcal{I}^{X_{i,t}} + f_s + f_t + \delta k_{i,t-1} + \epsilon_{i,t} \quad (6)$$

where $\Delta \log(k_{i,t+n}) \equiv \log(k_{i,t+n}) - \log(k_{i,t+n-1})$ is the log increase in capital expenditures between $t+n-1$ and $t+n$, $\Delta NIPS_{i,r,t} \equiv NIPS_{i,r,t} - NIPS_{i,r,t-1}$ is the change in NIPS between $t-1$ and t, $\mathcal{I}_{X_{i,t}}$ is an indicator function for whether either MRPK or TFPR is above the median. Finally, f_s are sector fixed effects and f_t are time fixed effects.[17]. The coefficient of interest is the one on the interaction term β^n, which can be interpreted as a semi-elasticity: a 1pp increase in NIPS leads to a β^n percentage change in net capital investment for firms with high TFPR or MRPK between year $t+n-1$ and year $t+n$.

2.3. Theoretical Foundations of the Firm Measures.

A key novelty of our analysis is the direct link between the securities data and an array of firms' production and financial wedges. But many of the firm-level measures, such as TFPR, MRPK and markups are related. In what follows we outline simple theoretical relationships between these variables, following Hsieh and Klenow (2009). Next, we provide a description of the more traditional financial measure, which we construct using firm-level data on asset prices and debt.

Theoretical background for TFP, MRPK and Mark-ups. We lay down a simple framework

17 For claims we also include region fixed effects.

that leads to expressions of mark-ups and MRPK as functions of observables from accounting data, incorporating multiple possible wedges arising in output and input markets.

Consider a continuum of monopolistic competitive firms that produce using capital, labor and intermediate goods with the following production function,

$$Y_i = A_i F(K_i, L_i, M_i), \tag{7}$$

where A_i denotes firm i's physical productivity (TFPQ), K, L and M denote capital, labor and material inputs. F is assumed to have constant returns to scale. The firm faces a demand curve:

$$Y_i = Y\phi(\frac{p_i}{P}), \tag{8}$$

where Y is some aggregate demand term, p_i is the price of the good produced by firm i, P is a price index, and $\phi(.)$ represents the demand curve, assumed to slope down: $\phi'(.) \leq 0$. For future reference, we denote $\sigma_i = -\phi'(\frac{p_i}{P})/\phi(.) > 0$ the elasticity of demand. Firms' profits are given by:

$$\pi_i = (1 - \tau_i)p_i Y_i - \sum_x (1 + \tau_{ix})p_x x_i \tag{9}$$

where x denotes the various inputs (K, L, M), with corresponding price p_x. τ_i denotes a firm-specific scale distortion and τ_{ix} denotes a firm-specific subsidy or tax on factor x. Together, τ_i and $\{\tau_{ix}\}$, represent firm-specific wedges that distort the equilibrium allocation. Note that factor prices are assumed to be identical. Equivalently, variation in factor prices is interpreted as variation in firm-specific input wedges. The wedges can have multiple interpretations: subsidies or taxes, frictions in the factor or credit markets, etc. Wedges and factor prices are taken as given by the firm.

The firm chooses inputs by maximizing eq. (9), subject to the production function eq. (7) and demand constraint eq. (8). In Appendix B.1, we obtain from the firms' optimization problem measurable expressions for mark-ups and MRPK. Specifically, we show that the above framework leads to the following observable 'wedge-adjusted' measure of mark-ups:

$$\tilde{\mu}_i = \frac{\theta_{ix}}{\chi_{ix}} \tag{10}$$

where θ_{ix} is the elasticity of output to input x and χ_{ix} is the cost share for input x. This wedge-adjusted markup is defined as the true markup relative to the (unobservable) output wedge $1 - \tau_i$. This also leads to the following modified but observable measure of MRPK:

$$\widetilde{MRPK}_i = \theta_{ix} \frac{p_i Y_i}{K_i} \tag{11}$$

where the modified MRPK is scaled up by the true (unobservable) markup.

In Appendix B.2, we show that the expressions for the modified MRPK, TFPR and the wedge-adjusted mark-ups all bear a relation to each other and to the underlying true measures. This motivates our choice of evaluating the relationship between each of these firm-level measures and NIPS.

Firms with high TFPR must have a high markup or a high marginal revenue product (but not necessarily high physical productivity). Similarly, firms with high modified-MRPK must have high capital wedge or high wedge-adjusted markup. Finally, firms with high wedge-adjusted markup must have either high markup or high output wedge. Typically, these firms have inefficiently low scale, reflecting a misallocation of resources.

Using accounting data from Compustat Global, we can measure both wedge-adjusted markup and modified MRPK in the data, alongside estimates of firm TFPR. To estimate this, and also the elasticity of output to capital used in the calculations of the MRPK, we follow the method of Olley and Pakes (1996). Details on this are in Appendix B.3. The baseline estimation for Olley and Pakes (1996) production function is at the sector level, using the sector classification available in TIC as baseline. Wedge-adjusted mark-ups are also estimated, using the observables outlined above using the method in De Loecker and Warzynski (2012). More details on the derivations that lead to the wedges, as well as details on the data used in the estimation, as well as the adjustment done for cross-country comparability are reported in Appendix 3.3.

With a slight abuse of language, we refer in what follows to $\tilde{\mu}_i$ as the markup and to $\widetilde{MRPK}$ as MRPK.

2.4. Other Firms Measures

To provide a comprehensive account of how international funding is allocated across various firms characteristics, we construct other firms measures that characterize either the production process or the degree of credit risk. We focus on intangible capital, as it is increasingly relevant for the production process, and distance to default.

Intangible Capital. We construct a measure of intangible capital based on Selling, General and Administrative (SG&A) expense data using the perpetual inventory method. Intangible capital accumulates as follows:

$$K^I_{i,t+1} = K^I_{i,t} + (1-\delta^I)K^I_{i,t}\frac{P^I_{t+1}}{P^I_t} \tag{12}$$

for firm i and where P^I_t is the CPI of each country in local currency.[18] To set eq. (12) in motion, we initialize intangible capital using:

$$K^I_{i,0} = \frac{I^I_{i,0}}{g^I_{Ind_i} + \delta^I - \pi^I_{Ind_i}(1-\delta^I)} \tag{13}$$

where $I^I_{i,0}$ is the investment in organizational capital in the first year of the sample, $\pi^I_{Ind_i}$ is the average price growth in each industry-country pair, and $g^I_{Ind_i}$ is set equal to the average growth rate of SG&A expenditure in the industry. Industries are classified based on the 2-digit NAICS code.[19]. Equation (12) is computed by iterating forward and starting from the initial level of intangible capital. Units of the final measures are in millions of dollars.

Credit Risk. We measure credit risk with the Merton distance to default (see Merton (1974)).

18 Following Eisfeldt and Papanikolaou (2013) or Peters and Taylor (2017) we set organization capital investment to be equal to 30% of SG&A expenditures.

19 Following Eisfeldt and Papanikolaou (2013) we set δ^I equal to 20%

This is obtained using information on the firms' market value of assets and on the value of equity and debt, which we obtain from Refinitiv. The distance to default is derived under the assumption that debt maturities are homogeneous and that the capital structure is such that the value of the firm assets are divided between debt and equity: $V_t^a = D_t + V_t^e$.[20] Using the Black and Scholes formula and Ito's lemma,[21] one can obtain the mean and volatility of asset values, which in turn deliver the default threshold. The distance to default is the difference between the expected value of the asset and the default point as follows:

$$D2D_t = \frac{log(\frac{V_t^a}{D} + (r - \frac{1}{2}\sigma_a^2(T-1)}{\sigma_a\sqrt{T-t}} \tag{14}$$

where r is the risk free rate, T is the maturity of the debt, V^a is the value of firm assets, and σ_a is its volatility. A smaller value of $D2D$ indicates that a firm is closer to default.

Summary statistics for our regression variables are in Table 1.

3. Capital Allocations across Firms.

Before presenting the estimates from our econometric specifications, we present time-series and cross-sectional evidence on the relationship between cross-border investment and firm-level measures. In this section we focus on markups as a primary wedge. Our goal is to examine the distribution of the mark-ups for firms in the TIC sample over time to see how misallocation has evolved over time. Wedge dispersion indicates misallocation and its shift over time indicates changes in allocative efficiency. To this purpose, we compute kernel densities and other moments, and examine their evolution over two different time sub-samples for all firms present in the claims or liabilities of the TIC dataset.

First, Table 2 presents mark-up means and standard deviations for US and foreign firms over three periods: 2003-2009, 2009-2016, and 2017-2022. Mean and standard deviations of mark-ups for US firms are larger than that of foreign firms. Moreover, both have increased over time for US and

20 The calculation ignores dividends or coupons; it is assumed that there are no short sales.

21 Asset values are assumed to follow a Geometric Brownian motion.

foreign firms, but more for US firms. As is well known, an increase in dispersion may be associated with a decline in aggregate TFP under certain assumptions (see Hsieh and Klenow (2009)).

Figure 1 plots the kernel densities of the markups for the firms that are in our TIC sample over the same periods: 2003-2009 and 2017-2022. There is a shift over time of the distribution toward the upper tails, which is significant according to the Kolmogorov-Smirnov test also reported in the figure.[22] In other words, there has been a significant shift upward across the two sample periods in the mark-ups for both claims and liabilities. In Figure 2 we report the kernel densities by industry sector. The upward shifts are evident in most sectors, although shifts are somewhat stronger for IT-pharma and financial sectors. They are also large and significant according to the Kolmogorov-Smirnov test[23], reported on the top right of Figure (2). The shift upward in the distributions is compatible with recent evidence by Loecker et al. (2020).

Overall, two main messages emerge from these statistics. First, the dispersion in the markups is evidence of misallocation. Second, the upward shift in the distribution for the firms in the TIC sample is indicative either of a growth of wedges at the top of the firms in international portfolios or a reallocation of international securities holdings toward firms with high wedges. Next, we test formally whether a significant allocation to the top of the distribution has taken place and document whether it emerged though a reallocation of the shares across firms.

3.1. Baseline Results: the Allocation of Capital Flows.

Our baseline specification, shown in eq. (3), aims to assess how capital flows have been allocated along the distribution of firms. Results are shown in Table 3 for the relation with TFPR, MRPK and mark-ups and in Table 4 for the relation with intangible and distance to default. In those tables results are shown for US liabilities (foreign holdings of US firms) and for US claims (US holdings of foreign firms) within regions. Tables 5 and 6 present the results for the specification for US claims

22 The test for equality of the distributions is rejected for both US and foreign firms

23 Given the number of observations in our sample, 21,000 firms, the threshold for the D-stat that rejects the null hypothesis of no significant shift is given by $D_{threshold} = \frac{1.36}{(21{,}000^2)} = 0.0030$. Any value larger than that implies that there has been a significant shift in the distribution across the two sample periods.

when the NIPS is defined as net of the market cap in the global portfolio. A positive value of α^j signals an allocation to firms with higher values of firm measure j.

For US liabilities (foreign holdings of US firms), the coefficients on most variables are positive and the ones on mark-ups, productivity, and intangible capital are significant at 95%. The distance to default is significant at 95% when the specification controls for the Sharpe ratio. The coefficients are economically meaningful given the small means and standard errors reported in the summary statistics (Table 1). For example, a one standard deviation increase in the markup corresponds to a 0.0063 increase in the NIPS. This is larger than the standard deviation of the NIPS reported in Table 1, and is larger than moving from the 25$^{\text{th}}$ to the 75$^{\text{th}}$ percentile of the distribution of net share.

For claims within regions (US holdings of foreign firms), US investors also tend to allocate capital toward the top of the distribution for most of the firms' measures. The estimated coefficients are large and significant only for MRPK and the probability of default (which is inversely related to the distance to default), our measure of credit risk. However, in this case the economic magnitudes of these coefficients are smaller. For example, a one standard deviation increase in MRPK corresponds to a 0.0183 increase in the regional NIPS. This is small relative to the net share statistics reported in Table 1.

Results are different when the NIPS is defined net of the share in the global market cap for claims (tables 5 and 6). Compared to the within-region results, the allocation to the top is now significant for TFPR and intangibles (the latter only at 10%). A 1-standard deviation increase in TFPR in foreign firms corresponds to a 0.0505 increase in the NIPS – almost a one standard deviation increase. This is equivalent to moving from the median to the 90$^{\text{th}}$ percentile of the distribution of NIPS. Thus this increase is economically meaningful.

Note that in both cases, international equity capital flows are allocated to firms with high wedges, as reflected either in large MRPK, mark-ups, or credit risk. Since those firms are also smaller, the allocation of resources toward those firms might reduce misallocation if these firms become relatively larger. In Section 3.3, we examine whether international capital flows are associated with subsequent increase in firms' capital expenditures.

Robustness checks. We test the robustness of our results in several ways. Results are reported in the other columns of Tables 3 - 6. First, we re-estimate the specifications controlling for industry fixed effects. Results remain significant, except for MRPK for foreign firms. The coefficients remain of the same size, although the magnitudes decline somewhat.

Another concern that may arise is whether our measures are simply capturing the effects of firm size. To address this, we add a control for firm size to the baseline regression. We use sales as a proxy for firms' size. Once again our results remain robust.

Next, we wish to assess the informative role of our firm measures on top and above traditional financial measures. We add the Sharpe ratio, a measure of excess returns given risk, to our baseline regression table.[24] First, the significance and magnitude of all other measures are little changed. The Sharpe ratio is highly significant but the direction of the effect differs. Foreign investors prefer less risk - a lower Sharpe ratio - when investing in the US, while US investors prefer riskier firms when investing abroad.

Finally, the estimation of the production functions entails a number of choices that we described in Appendix B. For robustness, we repeated the estimates by varying the sector categorization from the one available in TIC to the 2-digit NAICS. Results are reported in Tables 3 - 6 under the row with the acronym NAICS. Results remain robust in this case too.

Threats to identification. The dependent variables in our regressions are the shares within the TIC data, hence for the set of securities included in observed international portfolios. One concern that may arise is whether the allocation to the top that we document would hold in the full set of available securities, including those not included in international portfolios. A bias could arise if a significant share of securities is not held in the international portfolio. To exclude such a possibility, we compare the market capitalization of the firms included in the TIC dataset to the one of all firms in Worldscope, the dataset from which we draw our observations on market cap. This is a

24 The data available to compute the Sharpe ratio, which require monthly returns are available only from 2003, hence for this specification our sample size is smaller.

non-trivial task, since firms may change name, ID or merge, hence for a careful comparison, we have to track those changes. Our comparison shows that only 5% of US firms, and roughly 10% of foreign firms, as a share of market capitalization, are not included in the TIC dataset. This is a very low share that reassures us that selection bias is limited. Interestingly, we find that for foreign firms roughly 5% of the unmatched market capitalization are firms from China. For those, it is likely the case that constraints such as capital controls represent a significant impediment to international holdings, therefore strengthening the case against a selection bias.

3.2. Within-Between Decomposition

A first assessment of the macro implications of the allocation of cross-border investment can be done by examining the changes in firm productivity and other measures over time, and by decomposing it into the within- and between- firm components. This allows us to document whether the shifts toward the top tails of the distribution, which we noted earlier, are the result of a reallocation of cross-border investment toward the firms with higher productivity and markups, or are due to the fact that cross-border investors held firms whose productivity and markups increased over time.

Figure 3 plots a three-year rolling window of the within-between decomposition for productivity, MRPK, and markups. The between-firm component is prevalent for all the measures for both US and foreign firms, comprising more than 80% of the changes in all years. In addition, the between component is mostly positive, which implies that investors shift their holdings toward firms at the top of the distributions of each variable. There is also a notable pattern in the reallocations across firms over time. They are notably positive in the earlier and the later parts of the sample, and small or negative around the time of the 2008-09 global financial crisis.

3.3. Real Effects of Capital Flows

Lastly, we examine whether international capital flows have real effects. Exploiting the heterogeneity in our data, we ask which type of firms respond to higher cross-border inflows by increasing investment. To answer this question, we estimate the firm-level specification, spelled out in eq.

(6), that links the projected change in investment one, two or four years ahead with the change in the net portfolio share interacted with a dummy capturing whether either MRPK or TFPR are above the median in the year. The specification includes the constituents of the interaction term as separate regressors, as well as past capital and sector fixed effects. For claims, we also include region fixed effects. The coefficient on the interaction term, if positive, implies that firms, whose TFPR or MRPK are above the median, respond to inflows by increasing capital expenditures. We run this regression for both claims (foreign firms) and liabilities (US firms).

Results are shown in Table 7. First, for US firms (upper part of the table) an increase in NIPS is associated with an increase in tangible capital investment one year ahead for firms whose TFPR is above the median. The coefficient is significant at the 10% level and the increase in investment is economically meaningful; a one percentage point increase in NIPS leads to 0.54% increase in tangible capital investment. For US investment in foreign firms, we also observe a small but statistically significant increase in one-year-ahead investment for firms with MRPK above the median. At longer horizons, we observe instead a significant decrease in tangible capital for foreign firms whose TFPR or MRPK is above the median. Taken together, those results indicate that increased equity participation in foreign firms from US investors are associated with a slightly significant effect on near-term investment when foreign firms are highly productive, but followed by reduced investment the following year.

The results are supportive of an allocative effect of larger equity holdings on cross-border investment for both US and foreign firms at short horizons.

4. Conclusions

There is growing evidence that the misallocation of resources is a key driver of growth. Financial globalization and the increasing role of the private sector in the global economy have heightened interest in understanding the allocative role of international capital flows and their macroeconomic effects. Our paper is the first to tackle this topic using firm-level cross-border equity allocations in and out of the US, paired with the corresponding firm-level measures of productivity and efficiency.

Our analysis uncovers that cross-border investment is tilted toward firms at the top of the productivity and efficiency distributions, but with different implications. US investors tend to allocate shares to foreign firms facing large wedges; this can foster their growth and increase efficiency. Foreign investors tend to invest more in highly productive US firms with high amounts of intangible capital. In addition, firms' measures of production efficiency have a good predictive power for future capital flows, on top of and above financial measures.

Finally, firms that receive more cross-border funding tend to increase investment. However, in line with the misallocation literature, which emphasizes heterogeneity in production efficiency across firms, only relatively productive firms with a productivity above the median increase their investment.

Our paper adds to the understanding of the misallocation process and how it has evolved. The implications for global capital flows and the evolution of growth and wealth are left for further work.

Figure 1: Markup Distributions. Kernel densities of markups for the firms whose equities are in the TIC data set over two time samples: 2003-2009 and 2017-2022. Securities are matched with markups computed using data from Compustat Global. Markups are weighted by market capitalization share of TIC holdings. The top right boxes report Kolmogorov-Smirnov tests for equality of distributions.

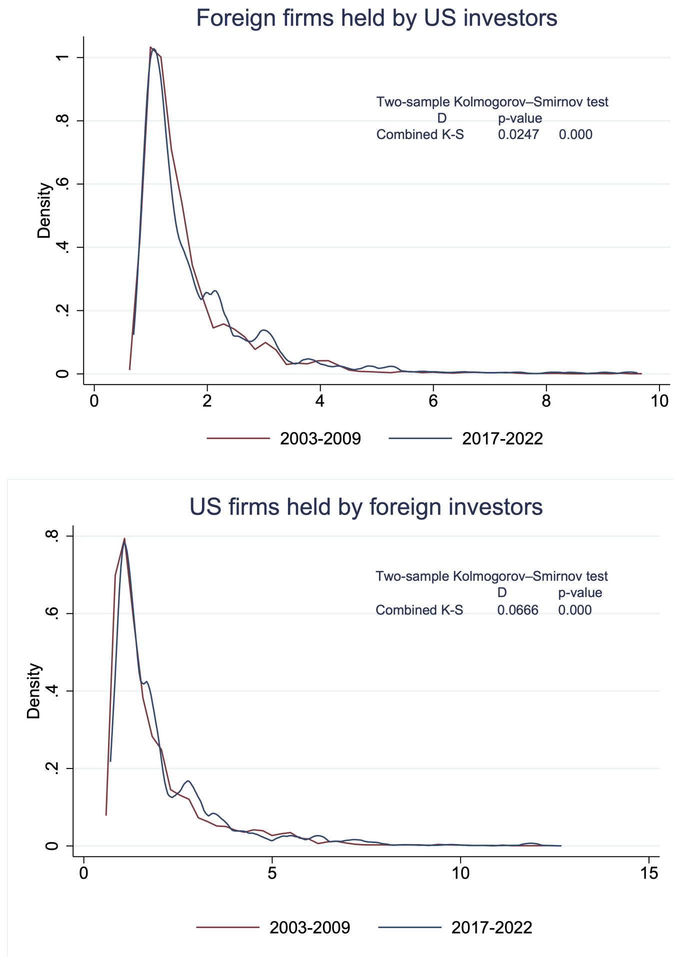
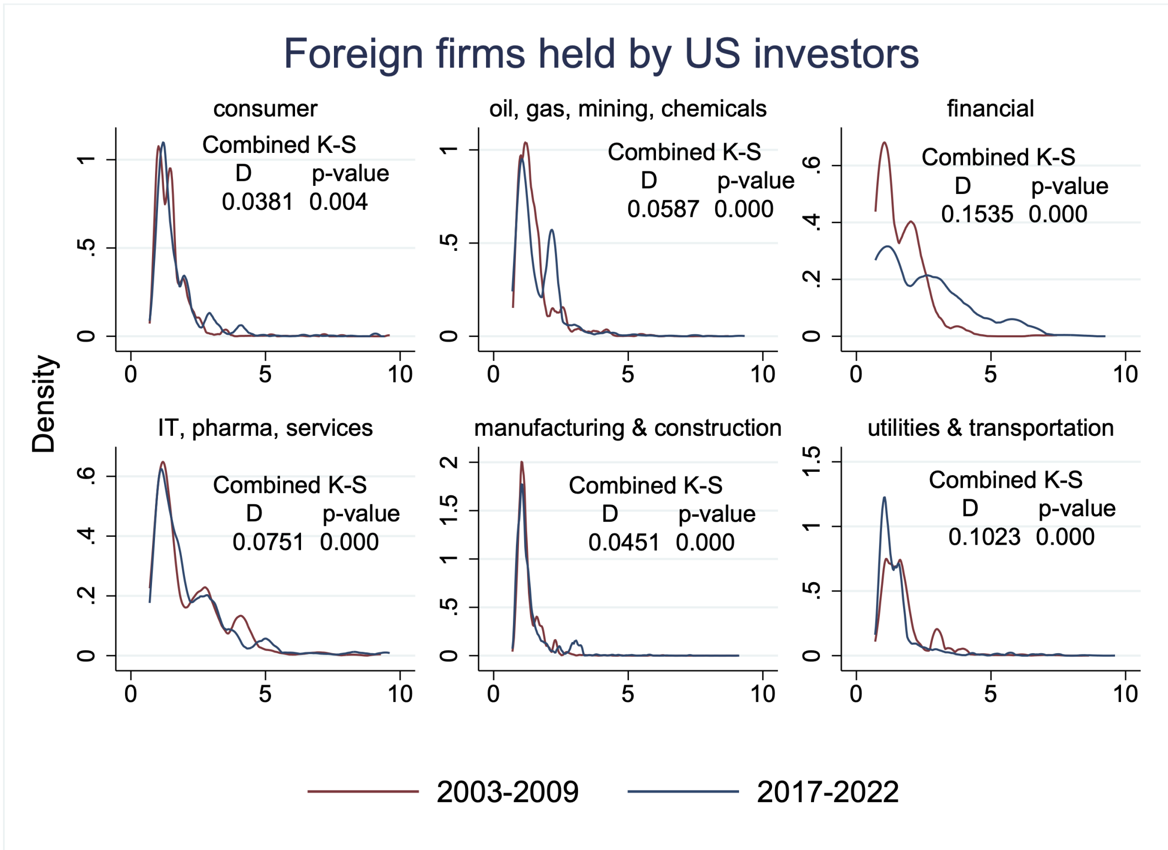


Figure 2: Markup Distributions by Industry. Kernel densities of markups for the firms whose equities are in the TIC data set over two time samples: 2003-2009 and 2017-2022. Securities are matched with markups computed using data from Compustat Global. Markups are weighted by market capitalization share of TIC holdings. The top right boxes report Kolmogorov-Smirnov tests for equality of distributions.



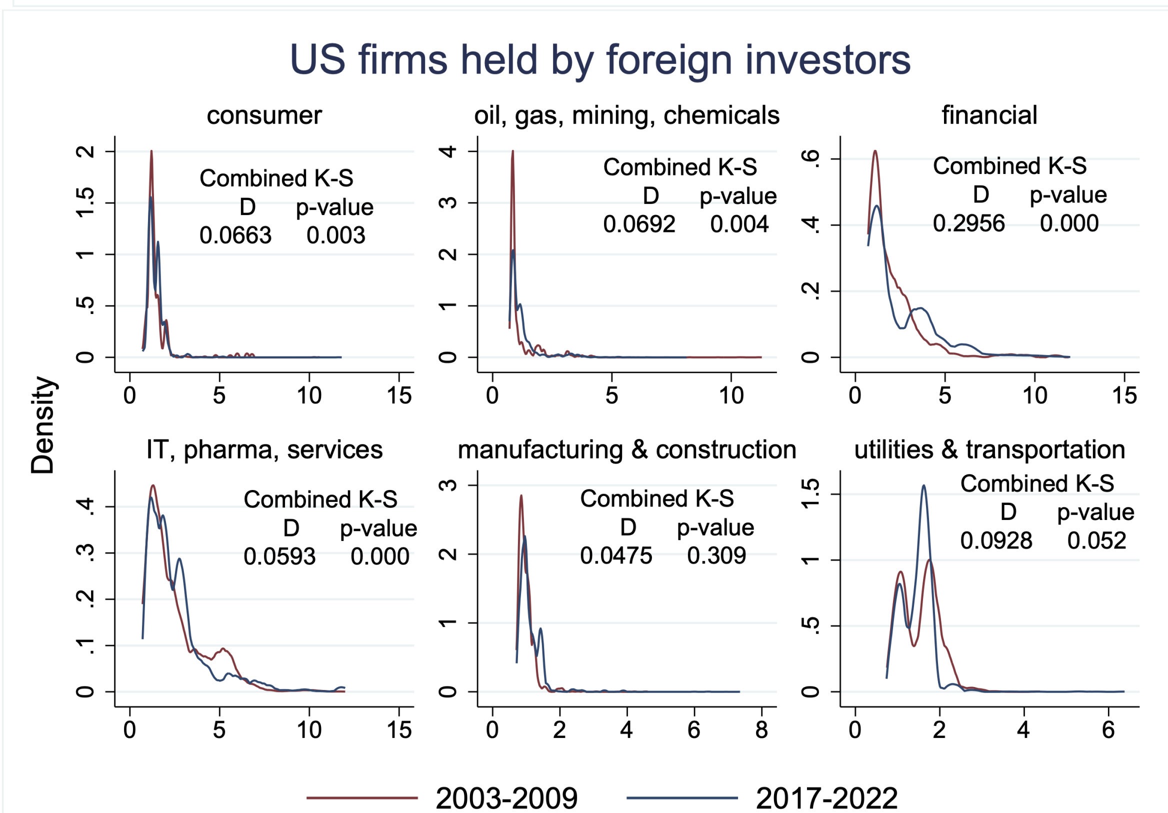


Figure 3: Within-Between Decomposition. Decomposition of changes in aggregate productivity, MRPK, and markups into within, between, and covariance effects. The bars plot the three-year moving average of each component. The aggregate measures are constructed by weighting each firm-level measure by the share of each firm in the TIC data set.

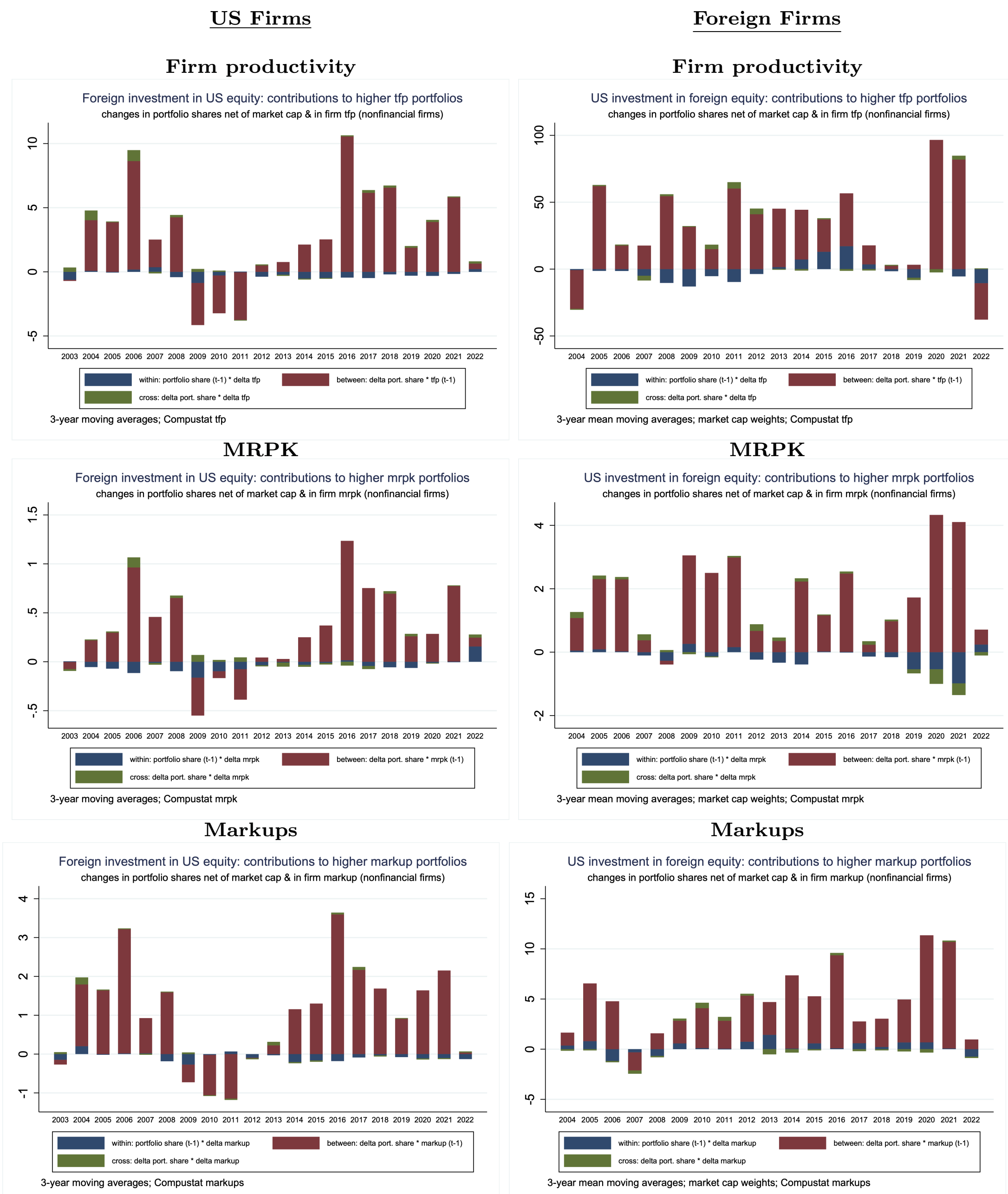


Table 1: Summary Statistics. Portfolio share, market cap share and net share (NIPS) in basis points. Wedge-adjusted markup, $\tilde{\mu}$, constructed using elasticities estimated with Olley and Pakes (1996) based on sector classification in TIC data and using firm level Compustat data. Modified MRPK, $\widetilde{MRPK}$, constructed using eq. (11). Revenue productivity (TFPR) estimated using Olley and Pakes (1996). Distance to default (D2D) is computed using the method in Merton (1974) and is expressed in standard deviations of the firm's assets. Intangible capital is measured with the perpetual inventory method using SG&A variable from Compustat: values are millions of US dollars, deflated with US CPI. For all countries other than US the values have been converted with exchange rates. Firms weighted by market capitalization share in the TIC data set.

	U.S. Firms				
	Mean	Std. dev.	Min.	Max	Obs.
Portfolio share	0.337	0.529	0.000	3.867	21,814
Market cap share	0.328	0.522	0.000	3.906	21,814
NIPS	0.009	0.055	-0.119	0.170	21,814
Markup, $\tilde{\mu}$	1.792	1.310	0.700	12.369	21,814
mod. MRPK, $\widetilde{MRPK}$	0.627	0.567	0.036	4.689	21,814
Productivity	4.454	2.576	0.731	17.039	21,814
Intangible cap.	7886	11742	10.032	80410	21,814
D2D	10.355	5.088	1.183	26.996	21,814
	Foreign Firms				
	Mean	Std. dev.	Min.	Max	Obs.
Portfolio share	0.491	0.885	0.000	8.138	48,896
Market cap share	0.489	0.830	0.002	8.290	48,896
NIPS (region)	0.002	0.242	-0.637	0.968	48,896
NIPS (total)	-0.002	0.066	-0.467	0.470	48,896
Markup, $\tilde{\mu}$	1.525	0.903	0.630	9.067	48,896
mod. MRPK, $\widetilde{MRPK}$	0.362	0.427	0.000	3.821	48,896
Productivity	6.030	6.563	0.302	55.097	48,896
Intangible cap.	4317	7306	3.003	54042	48,896
D2D	8.726	6.012	0.001	34.984	48,896

Table 2: Mark-up Statistics across Time Samples. The table presents mean and standard deviation of mark-ups for firms in the TIC dataset of claims and liabilities over three time samples. The moments are computed unweighted and weighted by market capitalization.

	US Firms					
	Unweighted			Weighted		
Time Sample	2003-2009	2010-2016	2017-2022	2003-2009	2010-2016	2017-2022
Mean	1.57	1.59	1.67	1.70	1.83	1.95
Standard Deviation	1.21	1.25	1.34	1.35	1.43	1.54
	Foreign Firms					
	Unweighted			Weighted		
Time Sample	2003-2009	2010-2016	2017-2022	2003-2009	2010-2016	2017-2022
Mean	1.43	1.45	1.46	1.67	1.63	1.67
Standard Deviation	0.83	0.87	0.91	0.97	0.98	1.06

Table 3: Baseline Regression Results. Estimates of the specification $NIPS_{i,r,t} = \gamma + \alpha_i^j x_{i,t}^j + f_r + f_t + \epsilon_{i,t}$ linking firm shares in the TIC data set, net of market capitalization (NIPS) to firm measure j, namely Olley and Pakes (1996) revenue productivity, MRPK, markup. The baseline firm measures are based on sector classification in TIC data; robustness is performed using the 2 digit NAICS classification. Regressions are run separately for foreign firms (claims) and US firms (liabilities). Coefficients are standardized to represent the percentage increase in the net share in response to a 1 standard deviation increase in the dependent variable. Firm measures are estimated using data from Compustat Global adjusted across countries by country CPI. Regression includes year and region fixed effects. Time period 1995-2022. Robust standard errors clustered at firm level. Standard errors are shown in parenthesis. Legend: *** is 1%, ** is 5%, * is 10%

	US Firms (liabilities)														
	Mark-Up					MRPK					TFPR				
NIPS	0.0063***		0.0063***	0.0085***	0.0041**	0.0006		-0.0003	0.0021	-0.0029*	0.0056***		0.0052***	0.0065***	0.0034*
	(0.00159)		(0.00152)	(0.00242)	(0.00167)	(0.00152)		(0.00152)	(0.00225)	(0.00158)	(0.00157)		(0.00150)	(0.00209)	(0.00177)
NIPS (NAICS)		0.0056***					0.0023					0.0036***			
		(0.00183)					(0.00154)					(0.00128)			
Size			0.0023***					0.0019**					0.0017**		
			(0.00088)					(0.00092)					(0.00084)		
Sharpe Ratio				-0.0137***					-0.0133***					-0.0138***	
				(0.00170)					(0.00175)					(0.00170)	
FE Time	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FE Sector					X					X					X
Obs.	21,814	20,335	21,650	13,291	21,814	21,814	20,335	21,650	13,291	21,814	21,814	20,335	21,650	13,291	21,814
	Foreign Firms (claims)														
	Mark-Up					MRPK					TFPR				
NIPS	0.0067		0.0071	0.0053	0.0013	0.0183***		0.0180***	0.0187***	0.0060	0.0024		0.0030	0.0019	0.0051
	(0.00670)		(0.00692)	(0.00683)	(0.00662)	(0.00647)		(0.00661)	(0.00654)	(0.00564)	(0.00768)		(0.00799)	(0.00776)	(0.00779)
NIPS (NAICS)		0.0047					0.0157**					-0.0077			
		(0.00645)					(0.00666)					(0.00602)			
Size			-0.0036					-0.0036					-0.0040		
			(0.00414)					(0.00405)					(0.00407)		
Sharpe Ratio				0.0153***					0.0149***					0.0156***	
				(0.00426)					(0.00421)					(0.00424)	
FE Region	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FE Time	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FE Sector					X					X					X
Obs.	48,896	51,266	46,895	47,679	48,896	48,896	51,266	46,895	47,679	48,896	48,896	51,266	46,895	47,679	48,896

Table 4: Baseline Regression Results. Estimates of the specification $NIPS_{i,r,t} = \gamma + \alpha_i^j x_{i,t}^j + f_r + f_t + \epsilon_{i,t}$ linking firm shares in the TIC data set, net of market capitalization (NIPS) to firm measure j, intangible capital (computed with perpetual inventory method), and Merton distance to default (D2D). Regressions are run separately for foreign firms (claims) and US firms(liabilities). Coefficients are standardized to represent the percentage increase in the net share in response to a 1 standard deviation increase in the dependent variable. Firm measures are estimated using data from Compustat Global adjusted across countries by country CPI. Regression includes year and region fixed effects. Time period 1995-2022. Robust standard errors clustered at firm level. Standard errors are shown in parenthesis. Legend: *** is 1%, ** is 5%, * is 10%

	US Firms (liabilities)							
	Intangible				D2D			
NIPS	0.0018**	0.0040***	0.0017*	0.0018**	0.0017	0.0010	0.0055***	-0.0002
	(0.00084)	(0.00124)	(0.00106)	(0.00073)	(0.00177)	(0.00177)	(0.00210)	0.00166)
Size		-0.0015				0.0019**		
		(0.00122)				(0.00092)		
Sharpe Ratio			-0.0131***				-0.0149***	
			(0.00183)				(0.00183)	
FE Time	X	X	X	X	X	X	X	X
FE Sector				X				X
Obs.	21,814	21,650	13,291	21,814	21,814	21,650	13,291	21,814

	Foreign Firms (claims)							
	Intangible				D2D			
NIPS	-0.0008	0.0072	-0.0012	0.0006	-0.0129**	-0.0169***	-0.0161**	-0.0178***
	(0.00626)	(0.010231	(0.00632)	(0.00597)	(0.00623)	(0.00602)	(0.00641)	0.00619)
Size		-0.0084				-0.0055		
		(0.00735)				(0.00408)		
Sharpe Ratio			0.0153***				0.0198***	
			(0.00421)				(0.00422)	
FE Region.	X	X	X	X	X	X	X	X
FE Time	X	X	X	X	X	X	X	X
FE Sector				X				X
Obs.	48,896	46,895	47,679	48,896	48,896	46,895	47,679	48.89648,896

Table 5: Baseline Regression Results, Alternative Definition of NIPS using Total Holdings and Shares. Estimates of the specification $NIPS_{i,r,t} = \gamma + \alpha_i^j x_{i,t}^j + f_r + f_t + \epsilon_{i,t}$ linking firm shares in the TIC data set, net of market capitalization (NIPS) to firm measure j, namely Olley and Pakes (1996) revenue productivity, MRPK, markup. The baseline firm measures are based on sector classification in TIC data; robustness is performed using the 2 digit NAICS classification. Coefficients are standardized to represent the percentage increase in the net share in response to a 1 standard deviation increase in the dependent variable. Firm measures are estimated using data from Compustat Global adjusted across countries by country CPI. Regression includes year and region fixed effects. Time period 1995-2022. Robust standard errors clustered at firm level. Standard errors are shown in parenthesis. Legend: *** is 1%, ** is 5%, * is 10%

	Foreign Firms (claims)														
	Mark-Up					MRPK					TFPR				
NIPS	0.0034		0.0005	0.0046	-0.0163	0.0362		0.0126	0.0372	0.0011	0.0505**		0.0513**	0.0512**	0.0451***
	(0.02313)		(0.02641)	(0.02253)	(0.02846)	(0.03362)		(0.00971)	(0.03550)	(0.01451)	(0.02058)		(0.02014)	(0.02081)	(0.01484)
NIPS (NAICS)		-0.0089					0.0557*					-0.0095			
		(0.02607)					(0.02985)					(0.01577)			
Size			-0.0423					-0.0420					-0.0422		
			(0.03399)					(0.03358)					(0.03321)		
Sharpe Ratio				-0.0312					-0.0322					-0.0299	
				(0.03730)					(0.03943)					(0.03779)	
FE Time	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FE Sector					X					X					X
Obs.	49,578	51,968	47,550	48,294	49,578	49,578	51,968	47,550	48,294	49,578	49,578	51,968	47,550	48,294	49,578

Table 6: Baseline Regression Results, Alternative Definition of NIPS using Total Holdings and Shares. Estimates of the specification $NIPS_{i,r,t} = \gamma + \alpha_i^j x_{i,t}^j + f_r + f_t + \epsilon_{i,t}$ linking firm shares in the TIC data set, net of market capitalization (NIPS) to firm measure j, namely intangible capital (computed with perpetual inventory method), and Merton (1974) distance to default (D2D). The baseline firm measures are based on sector classification in TIC data; robustness is performed using the 2 digit NAICS classification. Coefficients are standardized to represent the percentage increase in the net share in response to a 1 standard deviation increase in the dependent variable. Firm measures are estimated using data from Compustat Global adjusted across countries by country CPI. Regression includes year and region fixed effects. Time period 1995-2022. Robust standard errors clustered at firm level. Standard errors are shown in parenthesis. Legend: *** is 1%, ** is 5%, * is 10%

	Intangible				D2D			
NIPS	0.0089	0.0658**	0.0080	0.0098	-0.0378	-0.0587	-0.0354	-0.0516
	(0.01745)	(0.02698)	(0.01809)	(0.01531)	(0.04568)	(0.05186)	(0.04155)	0.04760)
Size		-0.0709*				-0.0440		
		(0.04069)				(0.03359)		
Sharpe Ratio			-0.0298				-0.0210	
			(0.04031)				(0.02832)	
FE Time	X	X	X	X	X	X	X	X
FE Sector				X				X
Obs.	49,578	47,550	48,294	49,578	49,578	47,550	48,294	49,578

Table 7: Future Growth Prospects Regression Results. The econometric specification is $\Delta \log(k_{i,t+n}) = \alpha^n + \beta^n \Delta NIPS_{i,r,t}\mathcal{I}^{X_{i,t}} + \gamma^n \Delta NIPS_{i,r,t} + \phi^n \mathcal{I}^{X_{i,t}} + f_s + f_t + \delta k_{i,t-1} + \epsilon_{i,t}$, where $\Delta \log(k_{i,t+n})$ is the log change in tangible capital, at time horizon n, $\Delta NIPS_{i,r,t}$ is the change in NIPS between t and t-1, $\mathcal{I}_{X_{i,t}}$ is an indicator function for whether either MRPK or TFPR is above the median. Finally, f_s are sector fixed effects. As before TFPR is estimated with Olley and Pakes (1996) using the TIC sector classification. Legend: *** is 1%, ** is 5%, * is 10%

	US Firms (liabilities)					
	Tangible Capital					
	1 Year Ahead		2 Years Ahead		4 Years Ahead	
$\Delta NIPS_{i,r,t}\mathcal{I}^{TFP_{i,t}}$	0.540*		0.312		0.081	
	(0.279)		(0.339)		(0.420)	
$\Delta NIPS_{i,r,t}\mathcal{I}^{MRPK_{i,t}}$		-0.085		0.211		-0.190
		(0.285)		(0.354)		(0.411)
FE Time	X	X	X	X	X	X
FE Sector	X	X	X	X	X	X
Obs.	10,616	10,616	9,175	9,175	6,913	6,913

	Foreign Firms (claims)					
	Tangible Capital					
	1 Year Ahead		2 Years Ahead		4 Years Ahead	
$\Delta NIPS_{i,r,t}\mathcal{I}^{TFP_{i,t}}$	0.029		0.048		-0.130*	
	(0.058)		(0.067)		(0.069)	
$\Delta NIPS_{i,r,t}\mathcal{I}^{MRPK_{i,t}}$		0.135**		-0.129**		-0.099
		(0.059)		(0.064)		(0.071)
FE Region	X	X	X	X	X	X
FE Time	X	X	X	X	X	X
FE Sector	X	X	X	X	X	X
Obs.	32,792	32,792	27,835	27,835	20,472	20,472

References

Aguiar, Mark and Manuel Amador, "Growth in the Shadow of Expropriation," *The Quarterly Journal of Economics*, 2011, *126* (2), 651–697.

Alfaro, Laura, Sebnem Kalemli-Ozcan, and Vadym Volosovych, "Why doesn't capital flow from rich to poor countries? An empirical investigation," *The Review of Economics and Statistics*, 2008, *90* (2), 347–368.

Autor, David, David Dorn, Lawrence F Katz, Christina Patterson, and John Van Reenen, "The fall of the labor share and the rise of superstar firms," *The Quarterly Journal of Economics*, 2020, *135* (2), 645–709.

Baqaee, David Rezza and Emmanuel Farhi, "Productivity and misallocation in general equilibrium," *The Quarterly Journal of Economics*, 2020, *135* (1), 105–163.

Bau, Natalie and Adrien Matray, "Misallocation and capital market integration: Evidence from India," *Econometrica*, 2023, *91* (1), 67–106.

Benigno, Gianluca, Luca Fornaro, and Martin Wolf, "The global financial resource curse," *American Economic Review*, 2025, *115* (1), 220–262.

Bertaut, Carol, Beau Bressler, and Stephanie Curcuru, "Globalization and the Reach of Multinationals Implications for Portfolio Exposures, Capital Flows, and Home Bias," *Journal of Accounting and Finance*, 2021, *21* (5), 92–104.

_ , Stephanie Curcuru, Ester Faia, and Pierre-Olivier Gourinchas, "New Evidence on the US Excess Return on Foreign Portfolios," *International Finance Discussion Papers 1398*, 2024.

Bloom, Nicholas and John Van Reenen, "Measuring and explaining management practices across firms and countries," *The quarterly journal of Economics*, 2007, *122* (4), 1351–1408.

Caselli, Francesco and James Feyer, "The Marginal Product of Capital," *The Quarterly Journal of Economics*, 2007, *122* (2), 535–568.

Cingano, Federico and Fadi Hassan, "International Financial Flows and Misallocation: Evidence from Micro Data," *CEPR Discussion Paper No. DP17186*, 2022.

Eisfeldt, Andrea L and Dimitris Papanikolaou, "Organization capital and the cross-section of expected returns," *The Journal of Finance*, 2013, *68* (4), 1365–1406.

Gopinath, Gita, Şebnem Kalemli-Özcan, Loukas Karabarbounis, and Carolina Villegas-Sanchez, "Capital allocation and productivity in South Europe," *The Quarterly Journal of Economics*, 2017, *132* (4), 1915–1967.

Gourinchas, Pierre-Olivier and Olivier Jeanne, "Capital flows to developing countries: The allocation puzzle," *Review of Economic Studies*, 2013, *80* (4), 1484–1515.

Hall, Robert E, "The relation between price and marginal cost in US industry," *Journal of political Economy*, 1988, *96* (5), 921–947.

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

Jones, Chad, *Misallocation, Economic Growth, and Input–Output Economics*, In: Acemoglu D, Arellano M, Dekel E, eds. Advances in Economics and Econometrics: Econometric Society Monographs. Cambridge University Press, 2013.

Loecker, Jan De and Frederic Warzynski, "Markups and firm-level export status," *American Economic Review*, 2012, *102* (6), 2437–71.

_ and Jan Eeckhout, "Global market power," *NBER working paper No. 24768*, 2018.

Loecker, Jan De, Jan Eeckhout, and Gabriel Unger, "The Rise of Market Power and the Macroeconomic Implications," *The Quarterly Journal of Economics*, 2020, *135* (2), 561–644.

Lucas, Robert, "Why Doesn't Capital Flow from Rich to Poor Countries?," *American Economic Review*, 1990, *80* (2), 92–96.

Mendoza, Enrique G, "Sudden stops, financial crises, and leverage," *American Economic Review*, 2010, *100* (5), 1941–1966.

Merton, Robert C, "On the pricing of corporate debt: The risk structure of interest rates," *The Journal of Finance*, 1974, *29* (2), 449–470.

Olley, G Steven and Ariel Pakes, "The Dynamics of Productivity in the Telecommunications Equipment Industry," *Econometrica*, 1996, *64* (6), 1263–97.

Peters, Ryan H and Lucian A Taylor, "Intangible capital and the investment-q relation," *Journal of Financial Economics*, 2017, *123* (2), 251–272.

Restuccia, Diego and Richard Rogerson, "Policy distortions and aggregate productivity with heterogeneous establishments," *Review of Economic Dynamics*, 2008, *11* (4), 707–720.

Rovigatti, Gabriele and Vincenzo Mollisi, "PRODEST: Stata module for production function estimation based on the control function approach," 2020.

Varela, Liliana, "Reallocation, competition, and productivity: Evidence from a financial liberalization episode," *The Review of Economic Studies*, 2018, *85* (2), 1279–1313.

A. Treasury International Capital Data: TIC and Measures of Returns

Overview of the TIC system. The TIC (Treasury International Capital) system collects data on US cross-border banking and securities positions and transactions. These data form the basis for the Bureau of Economic Analysis (BEA)'s official US balance-of-payments and international-investment-position data on portfolio investment, and are also used in the Federal Reserve's Financial Accounts data (Z.1 release) on rest-of-world portfolio positions and flows, and in the IMF's Coordinated Portfolio Investment Survey (CPIS).

Responsibility for the TIC system is shared by the US Treasury, the Federal Reserve Bank of New York, and the Federal Reserve Board of Governors. The Treasury oversees the TIC system and publishes a wide variety of tables and reports. The Federal Reserve Bank of New York is responsible for the primary collection and review of the data, and the Federal Reserve Board of Governors is responsible for additional data review, data adjustments, and production and dissemination of TIC tables and reports. Board of Governors staff with direct oversight and responsibility for TIC production have access to much more detailed breakdowns of the data than are available in published form, and much of the data used in this paper rely on these unpublished breakdowns.

The TIC reporting system consists of multiple forms that collect data at varying frequencies and degrees of aggregation. The dataset used in this paper is primarily drawn from the annual surveys, which collect data at the security level on US residents' debt and equity claims against foreign residents (that is, foreign securities held by US residents) and on US debt and equity liabilities to foreign residents (that is, US securities held by foreign residents). Liabilities surveys are conducted each year at the end of June; claims surveys are conducted at the end of December. Data are collected from US-resident custodians, issuers, and end investors. TIC annual securities reports and data-collection forms are available at the Treasury Department's TIC website: https://www.treasury.gov/resource-center/data-chart-center/tic/Pages/fpis.aspx.

The data are available publicly at aggregated level at this link. Specifically the dataset reports the break down of claims and liabilities of equity and debt, by both private and official investors, covering all countries in the US network of capital flows. The data also contain break down per investor type.

In principle the data covers a period that starts at around 1973. However a consistent reporting has been achieved only in more recent years. Hence our sample starts in 1995.

A.1. Further Details on Data Accuracy. Cross-Border Securities Holdings from TIC Annual Surveys

As noted above, the foreign securities holdings of US residents (claims) and the US securities holdings of foreign residents (liabilities) are collected by the US Department of Treasury in annual TIC surveys. Survey response is required by law under the authority of the International Investment and Trade and Services Survey Act and Executive Order 11961 of January 19, 1977. Data reported by individual respondents cannot be publicly disclosed and can only be shared with other Federal agencies. Aggregate data may be disclosed only in a manner which will not reveal amounts reported by individual respondents. The data collection is performed by the Federal Reserve Bank of New York, with additional validation by the Federal Reserve Board. Aggregate information by asset class and country is passed to the Bureau of Economic Analysis (BEA) for use in the US International Investment Position and Balance of Payments.

Claims. The annual TIC SHC form collects detailed security-by-security data on the foreign securities holdings of US residents. This data was collected for December 31, 1997, December 31, 2001, and annually as of December 31 since 2003. The report form and instructions is available at https://ticdata.treasury.gov/resource-center/data-chart-center/tic/Documents/shca2022in.pdf. Reporting institutions for US claims include US-resident custodians and end investors such as financial and non-financial bank and financial holding companies; pension fund managers; managers and administrators of mutual, hedge, and other funds; private equity and venture capital funds; insurance companies; foundations; university endowments; trusts and estates. Institutions must report securities issued by foreign resident organizations in the United States or abroad, including subsidiaries of US -resident organizations, and securities issued by international and regional organizations. Securities are reported based upon the country of residence of the issuer of the securities. Reportable securities include equities and related assets such as ADRs, and both short- and long-term debt securities including asset-backed securities. Firms must report a security ID (e.g., CUSIP), description, issuer name, security type, currency, type of US owner, fair value, number of shares, and the country of residence of issuer.

Liabilities. The annual TIC SHL form collects detailed security-by-security data on the US securities holdings of foreign residents. This data was collected for December 31, 1994, December 31, 1997, March 31, 2000, and annually as of June 30 since 2002. The report form and instructions is available at https://ticdata.treasury.gov/resource-center/data-chart-center/tic/Documents/shla2020in.pdf. Reporting institutions for US liabilities include US-resident custodians, including brokers and dealers and US central securities depositories, and US-resident issuers. Institutions must report all US securities they hold in custody for the account of foreign residents including their own foreign branches, subsidiaries, and affiliates. These securities must be reported by the US-resident custodian even if the securities are in turn held at DTC, Euroclear, or another central securities depository. US-resident issuers must report all securities issued by US-residents which are not held at a US-resident custodian or central securities depository. Firms must report a security ID (e.g., CUSIP), description, issuer name, security type, currency, type of US owner, fair value, and number of shares.

Data Validation and Additional Security Details. The Federal Reserve Bank of New York and the Federal Reserve Board validate some of the reported security prices by comparing the reported values across reporters, and with the value reporeted by an outside source such as Bloomberg when there appear to be errors. Additional information such as dividends, market capitalization, interest payments, and bond maturity are also obtained from descriptive information provided by the reporters or an outside source if needed.

B. Appendix on Firm Measures

B.1. Derivations for Expressions of MRPX and Mark-ups

The goal of this section is to obtain some expression of the wedges, specifically mark-ups and MRPK, as function of observables from accounting datasets. The firm chooses inputs by maximizing eq. (9), subject to the production function eq. (7) and demand constraint eq. (8). Let's denote ν_i the Lagrange multiplier on the demand constraint and λ_i the Lagrange multiplier on the production function. The first-order conditions from the firm optimization problem for the choice of output, output price and inputs are respectively:

$$
\begin{aligned}
&(1-\tau_i)p_i - \nu_i - \lambda_i = 0 \\
&(1-\tau_i)Y_i + \nu_i \frac{Y}{P}\phi'(\frac{p_i}{P}) = 0 \\
&-(1+\tau_{ix})p_x + \lambda_i A_i F_{xi} = 0,
\end{aligned}
\tag{15}
$$

where $F_{ix} = \frac{\partial F_i}{\partial x_i}$.

After substituting $Y_i = \phi(\frac{p_i}{P})Y$ and some re-arranging, we can re-write the first condition with respect to prices as follows:

$$
(1-\tau_i) = \frac{\nu_i}{p_i}\frac{-\phi'(\frac{p_i}{P})\frac{p_i}{P}}{\phi(\frac{p_i}{P})} = \sigma_i \frac{\nu_i}{p_i} \tag{16}
$$

where $\sigma_i = -\phi'(\frac{p_i}{P})/\phi(.)$ was defined in the main draft. Substituting ν_i from eq. (16) into the first-order condition for output yields:

$$
(1-\tau_i)(1-\frac{1}{\sigma_i})p_i = \lambda_i \tag{17}
$$

which, by denoting the mark-up as: $\mu_i = \frac{\sigma_i}{(\sigma_i - 1)}$, delivers:

$$
p_i = \mu_i(\frac{\lambda_i}{1-\tau_i}) \tag{18}
$$

where λ_i has the interpretation of a nominal marginal cost. For the pricing decision, this nominal marginal cost is inflated by a factor $1/(1-\tau_i)$ to offset the implicit 'tax' on output. From the first-order condition with respect to inputs, we obtain:

$$(1+\tau_{ix})p_x = \lambda_i A_i F_{ix} \Leftrightarrow \frac{(1+\tau_{ix})p_x x_i}{Y_i} = \lambda_i \theta_{ix} \tag{19}$$

where $\theta_{ix} = \frac{F_{ix}x_i}{F_i}$ is the output elasticity to factor x. For a Cobb-Douglas production function, it is constant. Substituting eq. (18) into eq. (19) and re-arranging delivers:

$$\frac{(1+\tau_{ix})p_x x_i}{p_i Y_i} = (1-\tau_i)\frac{\theta_{xi}}{\mu_i} \tag{20}$$

Defining the factor share in revenues: $\chi_{ix} = \frac{(1+\tau_{ix})p_x x_i}{p_i Y_i}$, and substituting into eq. (20) we obtain the following expression for the mark-up:

$$\mu_i = (1-\tau_i)\frac{\theta_{ix}}{\chi_{ix}} \tag{21}$$

From eq. (21), it follows that we can recover empirically the ratio of the true markup μ_i to the output wedge $(1-\tau_i)$, which we define as the 'wedge-adjusted markup,' $\tilde{\mu}_i$:

$$\tilde{\mu}_i \equiv \frac{\mu_i}{1-\tau_i} = \frac{\theta_{ix}}{\chi_{ix}} \tag{22}$$

The expression in eq. (22) is the one that we bring to the data, as we explain further below.

Next, we can derive an expression of MRPK by specifying that the production function is CES with elasticity of substitution ϵ:

$$Y_i = A_i(\sum_x \alpha_x x_i^{\frac{\epsilon-1}{\epsilon}})^{\frac{\epsilon}{\epsilon-1}} \tag{23}$$

Given this assumption, the output elasticity, θ_{ix}, satisfies the following condition: $\theta_{ix} = \alpha_x(\frac{x_i}{F_i})^{\frac{\epsilon-1}{\epsilon}}$. For the Cobb-Douglas case: $\epsilon = 1$ and $\alpha_x = \theta_{ix}$. Substituting $\theta_{ix} = \frac{F_{ix}x_i}{F_i}$ in the left side of

$\theta_{ix} = \alpha_x(\frac{x_i}{F_i})^{\frac{\epsilon-1}{\epsilon}}$ delivers: $F_{ix} = F_i^{\frac{1}{\epsilon}}\alpha_x x_i^{-\frac{1}{\epsilon}}$. Substituting into the first of the two relations in eq. (19) gives:

$$x_i = (\frac{(1+\tau_{ix})p_x}{\alpha_x \lambda_i A_i})^{-\epsilon} F_i \tag{24}$$

Substituting eq. (24) into the production function, we can solve for the marginal cost λ_i:

$$\lambda_i = \frac{1}{A_i}(\sum_x (\alpha_x)^{\epsilon}((1+\tau_{ix})p_x)^{(1-\epsilon)})^{\frac{1}{1-\epsilon}} \tag{25}$$

Substituting eq. (25) into the pricing condition eq. (18) delivers the output price as function of wedges and intermediate input prices:

$$p_i = \frac{1}{1-\tau_i}\frac{\mu_i}{A_i}(\sum_x (\alpha_x)^{\epsilon}((1+\tau_{xi})p_x)^{(1-\epsilon)})^{\frac{1}{1-\epsilon}} = \frac{\tilde{\mu}_i}{A_i}(\sum_x (\alpha_x)^{\epsilon}((1+\tau_{ix})p_x)^{(1-\epsilon)})^{\frac{1}{1-\epsilon}} \tag{26}$$

The marginal revenue product of factor X is defined as:

$$MRPX_i = \frac{\partial(p_i Y_i)}{\partial X_i} = p_i A_i F_{ix} + \frac{\partial p_i}{\partial Y_i}\frac{\partial Y_i}{\partial x_i} Y_i = p_i A_i F_{ix} + \frac{\partial p_i}{\partial Y_i} A_i F_{ix} Y_i \tag{27}$$

Substituting the definition of the product elasticity $\sigma = \frac{\partial p_i}{\partial Y_i}\frac{Y_i}{p_i}$ into eq. (27), and using the definition of the mark-up and the production elasticity with respect to inputs, we obtain:

$$MRPX_i = (1 - \frac{1}{\sigma_i})p_i A_i F_{ix} = \frac{1}{\mu_i} p_i A_i F_{ix} = \frac{1}{\mu_i}\theta_{ix}\frac{p_i Y_i}{x_i} \tag{28}$$

Equation (28) shows that MRPX depends on the markup which is not directly observable (only the wedge adjusted markup $\tilde{\mu}_i$ is directly observable). However, a *modified* MRPK defined as

$$\widetilde{MRPX}_i \equiv \mu_i MRPX_i = \theta_{ix}\frac{p_i Y_i}{x_i} = \tilde{\mu}_i(1+\tau_{ix})p_x \tag{29}$$

is observable. eq. (29) gives the formula for MRPK presented in the main text, eq. (11), once we specify the input as tangible capital. This is the baseline measure that we take to the data and use in our regression analysis. Importantly $\widetilde{MRPX}_i$ is measurable since both the elasticity, θ_{ix}, revenues, p_iY_i, and inputs, X_i, are all available in the data.

B.2. Relation between MRPX, mark-ups and TFPR

While the expression in eq. (29) is useful since it is measurable, we also observe that MRPK is ultimately a function of all wedges affecting the output and input markets. To see this, we can substitute the expression for F_{ix} into the expression for $MRPX_i$ to obtain:

$$MRPK_i = \frac{(1+\tau_{ix})p_x}{(1-\tau_i)} \tag{30}$$

Note that eq. (30) is not a function of firm TFPQ or the markup μ_i. However the expression in eq. (30) is also not measurable as it depends on the output wedge $(1-\tau_i)$, which is itself unobservable. This is why we must use instead the modified MRPK.

Lastly, we note that there is a relation between firm's TFPR (total factor productivity based on revenues) and mark-ups. Note that $TFPR_i = p_iA_i$, then using eq. (26), we obtain:

$$TFPR_i = \frac{1}{1-\tau_i}\mu_i(\sum_x \alpha_x^{\epsilon}((1+\tau_{ix})p_x)^{1-\epsilon})^{\frac{1}{1-\epsilon}} \tag{31}$$

Next, using eq. (30), one obtains:

$$TFPR_i = \mu_i(\sum_x \alpha_x^{\epsilon} MRPX_i^{1-\epsilon})^{\frac{1}{1-\epsilon}} \tag{32}$$

Finally, replacing $MRPX_i$ with $\widetilde{MRPX}_i$ delivers:

$$TFPR_i = (\sum_x \alpha_x^{\epsilon} \widetilde{MRPX}_i^{1-\epsilon})^{\frac{1}{1-\epsilon}} = \tilde{\mu}_i(\sum_x \alpha_x^{\epsilon}((1+\tau_{xi})p_x)^{1-\epsilon})^{\frac{1}{1-\epsilon}} \tag{33}$$

The last equation shows the relation between $TFPR_i$ and the modified MRPX, $\widetilde{MRPX}_i$.

B.3. Production Function Estimation.

To measure the TFPR outlined in our theoretical benchmark, we first need to estimate production functions. Note that in presence of misallocation, or heterogenous wedges, TFPR differ across firms. The underlying environment features $j = 1, ..., J$ firms in each period $t = 1, ..., T$. we observe output $Y_{j,t}$, labor, $L_{j,t}$, and capital, $K_{j,t}$. We consider an asymptotic of $J \to \infty$ for a fixed T. Let us assume Cobb-Douglas production function: $Y_{j,t} = A_{j,t} K_{j,t}^{\beta_K} L_{j,t}^{\beta_L}$. Taking the logarithms gives:

$$y_{j,t} = \beta_0 + \beta_k k_{j,t} + \beta_l l_{j,t} + \epsilon_{j,t} \tag{34}$$

where lowercase symbols represent natural logs of variables and $log(A_{j,t}) = \beta_0 + \epsilon_{j,t}$. This can be regarded as a first-order log-linear approximation of a production function. Equation 34 can be estimated with linear OLS regressions, but this entails potential biases. $\epsilon_{j,t}$ contains everything that cannot be explained by the observed inputs. When the manager of a firm makes an input choice, she should have some information about the realization of the residual. Hence, the input choice can be correlated with the residual. In this case the OLS estimator is biased. There are several methods to correct this bias. We follow the structural approach in Olley and Pakes (1996). The method consists in obtaining some structural restrictions to identify the residuals. Let us assume that $\epsilon_{j,t} = \omega_{j,t} + \eta_{j,t}$, $\omega_{j,t}$ is an anticipated shock and $\eta_{j,t}$ is an ex-post shock. Inputs are correlated with the first, but not with the second. Olley and Pakes (1996) use economic theory to derive a valid proxy for the anticipated shock. We can assume that investment is strictly increasing in the anticipated component: $i_{j,t} = f(k_{j,t}, \omega_{j,t})$. We can then invert the function and obtain:

$$\omega_{j,t} = h(k_{j,t}, i_{jt}) \tag{35}$$

The estimation procedure then consists in two steps. In the first step, one can estimate β_L and ϕ from:

$$y_{j,t} = \beta_0 + \beta_L l_{j,t} + \phi(k_{j,t}, i_{j,t}) + \eta_{j,t} \tag{36}$$

where ϕ is approximated with some basis functions, such as polynomials or splines. Once the investment functions are fixed, estimation is the same as the linear model. With the estimates from the first stage, the next step is to estimate:

$$y_{j,t} - \hat{\beta}_L l_{j,t} = \beta_0 + \beta_K k_{j,t} + g[\hat{\phi}(k_{j,t}, i_{j,t}) - \beta_0 + \beta_K k_{j,t-1}] + \nu_{j,t} + \tilde{\eta}_{j,t} \tag{37}$$

where $\hat{\omega}_{j,t} = g[\hat{\phi}(k_{j,t}, i_{j,t}) - \beta_0 + \beta_K k_{j,t-1}]$. We implement this procedure using the production function estimation package PRODEST by Rovigatti and Mollisi (2020). We obtain the estimate for the firm level TFP and also for the capital elasticities, which we use in the construction of MRPK, as outlined in the main draft.

For robustness reason we also perform the estimates under different specifications of the sectors and or the proxy for productions, for which we use revenues or value added. As explain in the text our results remain robust to alternative specifications.

Estimating Production Elasticities Across Regions. Recent work by De Loecker and Eeckhout (2018) also computes markups globally. To compute markups worldwide, De Loecker and Eeckhout (2018) use the US elasticities per sector and vary the denominator, namely the cost share of variable inputs. They argue that elasticities are largely similar across countries and within sectors and that their interest lies in uncovering time trends. Our goal on the contrary is to provide an exact mapping between the returns and the local firm characteristics. For this reason we extend the procedure by estimating local elasticities. Specifically, production function estimation is carried out for cells that interact two-digit industries and macro-regions. Macro-regions are defined following the detailed UN classification (e.g. Europe is partitioned into Southern, Eastern, Northern and Western Europe), with the exception of Latin America (which groups the UN-denominated regions of South America, Central America and Caribbeans) and Africa (which groups the UN-denominated regions of Northern, Western, Eastern and Southern Africa). The choice of this geographical level and the further aggregation for Africa and Latin America is driven by the trade-off between the preference for representative production function, which pushes for a finer partition, and the need for enough observations to generate high-quality estimates, which calls for further aggregation.

Furthermore we deflate the variable input cost shares by the price deflator per each sector region to reduce mis-measurement errors.[25]

Markups. We estimate the markups following the structural estimation approach pioneered in the industrial organization literature (see Hall (1988) or De Loecker and Warzynski (2012)). The general framework relies on using firms' first order conditions, together with accounting data and non-parametric estimates of the production elasticities. The method is based on agnostic assumptions about the form of market competition. The expression for the firm i markup, which is obtained by merging firms' first order conditions for labor and variable inputs, reads as follows:

$$\mu_{i,t} = \frac{\theta_{ix}}{\chi_{ix}} \tag{38}$$

where θ_{ix} is the output elasticity with respect to any variable input x, which could be either labor or other intermediate inputs, and χ_{ix} is the share in production of the variable input x.[26] The formula in 38 is in line with the one derived in our general theoretical framework, namely equation 10, in the main text. Note that for the mark-up estimates, production functions estimates, and their elasticities, are needed. For that we adopt Olley and Pakes (1996), as explained above.

B.4. Data Used for Estimation of Firm Measures and Wedges.

We obtain balance sheet measures from Compustat Global for the period 1990-2022 at yearly frequencies. For the production function estimation we employ, as proxy for output, either revenues, which is sales deflated by CPI, or or value added, sales net of intermediate inputs. Furthermore, we construct capital using a perpetual inventory method. Specifically, the variable PPEGT is a measure of the book value of the capital stock and is used to initialize the capital stock. Next, we iterate forward on capital using the accumulation equation $k_{it} = (1-\delta)k_{it-1} + i_{it}$ with the measure of net investment, $i_{it} - \delta k_{i,t-1}$ using the difference in the variable PPENT between time t and time $t-1$. All variables are deflated by CPI. These balance sheet variables have a yearly frequency

25 Price deflator per region and sector are obtained from the World Bank.

26 We use the first order condition for variable input, rather than the one on capital, as the latter may depend on adjustment costs.

and are expressed in local currencies. Each variable is thus converted in US dollars and deflated; data on exchange rates and price deflators (CPI) are taken from the World Bank, with the notable exception of Australia and New Zealand, whose price indexes are downloaded from OECD. Then, the natural logarithms of the real variables are used for the production function estimation - using the *prodest* Stata command developed by Rovigatti.

Country Grouping for Regional Estimation. Production function elasticities are estimated by sector. For some country-sector pairs the number of observations is not large enough for the production function estimation (see De Loecker and Eeckhout (2018). For this reasons most authors use in all cases the elasticities estimated for the US As we are matching with international data one of our goal is to provide the closest possible measurement of local production conditions. We therefore estimate regional elasticities by grouping in country-sector pairs. The country group that we apply is shown in the plot:

Elasticities are then always computed in two ways, either using specific country sectors (hence dropping the pairs for which there are not enough observations), or per country-sector grouping. In all cases we compare the numbers to the ones estimated in US sectors to assess the plausibility of the magnitudes.

Matching Between TIC and Firm Identifiers. The matching between TIC securities and firm identifiers passes through the Worldscope identifier as in Bertaut et al. (2021). Specifically we first apply a cross-walk from gvkey in Compustat and Worldscope identifiers. We then match the latter with the ISINs or CUSIP of the TIC securities. First we apply an exact matching on the identifiers, next to improve the coverage we apply a fuzzy matching using firm company name and addresses.