

# Competitiveness, Flexibility, and the Middle-Income Trap in Southeast Asia

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## Abstract

This paper explains the middle-income trap as failures to sustain competitiveness in a knife-edge regime. Competitiveness is defined structurally as the net return on capital (ROC), depending on capital accumulation, technological flexibility and macroeconomic stability. Using annual data for 14 Asian economies (ASEAN-10 plus China, Japan, Korea, and Taiwan), this paper finds that when nominal accommodation of wage and profit shocks substitutes for real reallocation, technological flexibility remains latent and does not translate into sustained profitability; when real adjustment is institutionally enforced, flexibility can stabilise capital returns and sustain convergence. The policy implication is that successful growth strategies require synchronising production-side flexibility with macroeconomic discipline: without institutions that channel income-claim pressure into productivity-enhancing transformation, higher flexibility alone is not a development strategy.

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## 1. Introduction

Many emerging economies stall before reaching high-income status. The World Bank (2024) identifies 108 economies trapped at middle-income levels in 2023, unable to sustain the productivity gains that propelled their initial rise. This is called the middle-income trap (Garrett, 2004), (Gill, Kharas, & alt., 2007). Some scholars question whether the concept describes a true "trap" or merely reflects different convergence paths (Im & Rosenblatt, 2013). Yet the empirical regularity is clear: growth decelerates after rapid acceleration phases, and this pattern appears across regions and time periods (World Bank, 2024). The analytical challenge is not whether slowdowns occur, but what drives them structurally.

Existing explanations emphasise a wide set of factors: lower productivity growth, incomplete structural transformation, insufficient innovation, rising unit labour costs, financial frictions, and institutional constraints. Yet these perspectives typically treat the determinants of competitiveness in isolation and offer limited insight into why countries differ so sharply in their capacity to reallocate resources as they develop. I propose to integrate them by describing regimes of competitiveness.

Most growth models assume stable technological parameters or constant factor substitutability, yet technological bias, skills, and institutional quality evolve in practice. Standard explanations of middle-income traps cite human capital deficits, weak institutions, or technological lock-in—but these are correlates, not mechanisms. I identify a deeper structural determinant that operates through two distinct forms of flexibility: The technological elasticity of substitution  $\sigma$  between capital and labour governs the flexibility with which economies can reallocate factors in response to changing costs. This shapes their production possibility frontier.

Yet technological flexibility alone does not guarantee growth. It is only economically relevant when distributional pressures cannot be absorbed through nominal adjustment; otherwise, technological flexibility remains latent and does not translate into higher profitability or growth. The distribution of income therefore determines the degree to which this potential is activated. Nominal claims by labour and capital owners shape production costs. How these claims adjust through wages and prices governs the efficiency with which economies reallocate factors and determines the trade-off between productivity, inflation, and employment. Institutions that maintain nominal price stability therefore enable economies to activate their technological flexibility. This combination of technological and institutional flexibility constitutes the development regime. Competitiveness—measured as the net return on capital—emerges from the interaction between these technological and institutional forces. The development regime influences growth by maintaining positive returns on capital, and these returns determine capital accumulation and growth

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Neoclassical models assume technology determines factor shares through marginal products. But when nominal wages and prices arise from bargaining and market power rather than market-clearing, the cost structure changes. The economy's supply side must then adjust to accommodate these distributional claims. The elasticity of substitution  $\sigma$  governs how efficiently this adjustment occurs. Higher  $\sigma$  allows firms to reallocate factors smoothly when costs change, sustaining profitability. Lower  $\sigma$  creates rigidity: capital accumulation encounters diminishing returns, choking competitiveness. Yet whether adjustment occurs through real factor reallocation or nominal price changes depends on the institutional macroeconomic framework for preserving price stability.

The real economy, described by the production function, interacts with nominal income claims. National income shares are determined by wage- and price-setting behaviour. In equilibrium the real wage is consistent with labour productivity and market structure, implying the corresponding equilibrium wage share. When nominal claims misalign with the cost structure, adjustment restores consistency between real supply and distributional claims. We distinguish two adjustment channels. Nominal adjustment occurs when changes in wages and prices reconcile nominal claims with given levels of productivity. Alternatively, real adjustment means the productive structure adapts to nominal pressures through changes in productivity, employment, or factor reallocation, restoring consistency between wages, marginal products, and profitability on the supply side.

The rate of profit bridges nominal and real adjustment. If the net return on capital is insufficient to cover the cost of capital, firms must restore profitability. If firms can raise prices, the prevailing technological structure can be preserved, and adjustment takes place in the nominal domain. In this case, growth is constrained not by the difficulty of altering productive structures, but because nominal accommodation weakens incentives for cost-reducing efficiency gains. However, price stability constrains nominal adjustment. Real changes in productivity, employment, or factor allocation must follow. Yet, a strong nominal anchor can coexist with a low capacity for technological adjustment. Prices remain stable, but productivity cannot respond flexibly to wage pressure. Distributional stress then reduces profitability, leading to declining investment and slower growth. This configuration—strong nominal anchoring combined with low real adjustment provides a central mechanism for the emergence of the middle-income trap.

This paper develops a framework in which economic development requires a combination of constrained nominal adjustment and technological flexibility. When prices and wages are flexible, income distribution has no impact on real growth. But when monetary policy provides a strong nominal anchor, distributional pressures cannot be absorbed through inflation. Wage rigidity then threatens profitability and therefore forces real adjustment. Provided the real adjustment increases productivity without reducing employment, such development is growth enhancing. But if this adjustment is technologically and institutionally

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constrained (by low elasticities of substitution), exiting the market or shedding labour may reduce real wages (the Philips curve logic). The middle-income trap emerges from two configurations. Technological rigidity limits real adjustment. Excessive nominal flexibility allows distributional conflicts to be resolved through prices rather than structural change. The technological elasticity of substitution between capital and labour ( $\sigma$ ) shapes the production possibility frontier. The institutional flexibility of wage and price formation determines the degree to which this possibility is realised.

I measure this institutional flexibility through two indices. The Adjustment Share Index (ASI) captures the economy's capacity to adjust through real rather than nominal channels. The Productivity Share Index (PSI) measures the degree to which real adjustment occurs through productivity gains rather than employment losses that reduce nominal wages. The *effective* elasticity of substitution observed at the macroeconomic level then reflects how technological flexibility  $\sigma$  interacts with these institutional constraints.

I argue that the middle-income trap reflects a knife-edge condition in the transition from middle to high income status. Growth slows not because technological flexibility is absent, but because it is activated prematurely. In poor economies capital is scarce; in rich economies labour is scarce. In middle-income countries, capital is no longer scarce, and labour is not yet scarce. In poor countries capital accumulation is complementary to workers and increases productivity. But in the middle-income countries, both too little and too much flexibility are harmful. With too little flexibility, capital cannot be redeployed efficiently and productivity falls. But too much flexibility generates capital substitution that displaces labour. In middle-income economies, where labour remains abundant and domestic demand is increasingly important, substitution reduces employment and wage income, weakening domestic demand and constraining scale economies. It therefore lowers profitability. Stimulating demand by relaxing nominal discipline generates inflation instead of productivity gains.

As capital deepens, a low technological elasticity of substitution limits the economy's ability to reallocate resources toward higher-value uses. Hence, improving technological flexibility is a necessary condition for sustained economic development. Institutional frameworks that maintain macroeconomic stability foster this technological adjustment. Yet, when nominal adjustment is constrained, insufficient real adjustment capacity depresses profitability and slows growth. Economies that escape the trap raise technological flexibility through skill formation, labour and capital mobility, and competition while avoiding nominal adjustment.

East and Southeast Asia provide a natural setting to examine this conjecture. While South Korea, Taiwan, Singapore, and of course Japan have reached advanced-economy status, most economies in the region remain middle income. Using a panel of fourteen Asian economies over the period 1970–2022, this paper documents substantial heterogeneity in both technological flexibility and growth performance. Descriptive evidence shows that elasticities

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of substitution vary widely across countries and over time. Middle-income economies did not experience systematic increases in flexibility during the period of accelerated capital deepening. Growth performances diverged sharply after the Asian Financial Crisis in the late 1990s, with persistent slowdowns concentrated in the middle-income group.

To evaluate the flexibility knife-edge, this paper combines structural measures of technological flexibility with evidence on nominal adjustment. I construct time-varying, country-specific elasticities of substitution between capital and labour from CES factor-share conditions and relate them to capital deepening and the net return on capital. I complement this analysis with vector autoregressions tracing wage and price adjustment following distributional shocks. Cross-country and time variation in observed inflation dynamics capture differences in the scope for nominal adjustment.

The central empirical finding is that technological flexibility and nominal rigidity are jointly necessary for real adjustment to support growth. Monetary anchors that stabilise prices do not directly raise growth; instead, by limiting nominal accommodation, they alter the mode of adjustment to distributional pressure and thereby shape incentives for productivity-enhancing reallocation.

The evidence supports a regime-dependent flexibility-deficit hypothesis. As capital deepens in middle-income economies, low elasticities of substitution are associated with declining returns on capital, reflecting limited scope for reallocating resources toward higher-value uses. Where nominal adjustment is unconstrained, price responses partially substitute for real reallocation, weakening the link between flexibility, profitability, and growth.

When nominal adjustment is constrained, wage pressure—whether driven by higher nominal wages or higher markups—is met primarily through real adjustment. If technological flexibility is also low, profitability is restored mainly through labour shedding rather than productivity growth, generating stagnation rather than convergence. Technology defines the feasible production frontier, while monetary conditions shape how distributional conflict is resolved. Effective adjustment depends on their interaction.

The empirical analysis therefore focuses on interaction effects between technological flexibility and the scope for nominal adjustment. The econometric specifications allow the impact of the elasticity of substitution on profitability and growth to vary with observed inflation dynamics and across stages of development. This implies that coefficients on technological flexibility are not expected to be uniformly positive: in environments with unconstrained nominal adjustment or outside the middle-income range, flexibility has limited real effects. Non-significant estimates in these cases are thus consistent with the model, reflecting substitution toward nominal rather than real adjustment rather than the absence of underlying structural constraints.

The remainder of the paper is organised as follows. Section 2 reviews the literature. Section 3 develops the theoretical framework. Section 4 presents estimates of elasticities for fourteen Asian economies. Section 5 estimates the determinants of profitability, flexibility, and growth. Section 6 concludes.

## 2. Literature background

### 2.1. The middle-income trap

Empirical work documents the middle-income trap across regions and time (Eichengreen, Park, & Shin, 2012), irrespective of whether one views the phenomenon as a literal “trap” or as divergent convergence paths. Existing explanations fall into four broad categories. Convergence-ratio approaches emphasise duration within income bands (Felipe, Abdon, & Kumar, 2012) (Aiyar, Duval, Puy, Wu, & Zhang, 2013). Growth-slowdown models highlight threshold effects associated with ageing, inequality, and skill constraints; (Eichengreen, Rhee, & Tong, 2004) (2012), (Eichengreen, Park, & Shin, 2014), (2013). Structural-change models trace slowdowns to exhausted reallocation from low- to high-productivity sectors frameworks (Lewis, 1954), (Kaldor, 1966), (Todaro & Smith, 2015), (Zhou & Hu, 2021), (Barro R. J., 2016). Institutional or innovation-based models attribute stagnation to failures of creative destruction theory (Aghion & Howitt, 2009), (Acemoglu, 2002), (Hausmann & Rodrik, 2003). While each perspective identifies important facts, they rarely explain how factor reallocation capacity evolves with development, nor why similar investment strategies yield sharply different outcomes across countries.

### 2.2. Competitiveness

A parallel literature attributes middle-income slowdowns to declining competitiveness (World Bank, 2014). Conventionally, competitiveness is proxied by export performance (Gill, Kharas, & alt., 2007) or composite indices combining institutions, education, and infrastructure (IMD World Competitiveness Ranking; the World Economic Forum's Global Competitiveness Index; the World Bank's Business Ready index). Some find causality runs from growth to competitiveness (Kordalska & Olczyk, 2016); others find the reverse (Gama, Bastos, & Martins, 2020). This suggests that the heterogeneity of such indices can lead to confusing results.

This paper adopts a more structural definition: competitiveness is measured by the net return on capital (ROC). Profitability governs investment decisions and thus resource allocation over time. By embedding ROC in an aggregate production structure, competitiveness becomes directly linked to technology, income distribution, and adjustment mechanisms, rather than inferred from composite indicators.

### 2.3. Development with technological flexibility

Standard growth models assume Cobb-Douglas production functions and constant technological parameters. In the Solow (1956) framework, diminishing returns and exogenous technical progress determine steady-state growth, while income distribution reflects marginal products. The CES production function relaxes the unit-elasticity assumption and allows distinct forms of technological change, but empirical applications maintain a constant elasticity of substitution ( $\sigma$ ).

Endogenous growth theory shows that innovation responds to incentives, relative factor prices, and institutions (Acemoglu, 2002), (Aghion & Howitt, 2009). Importantly, this implies that the elasticity of substitution between capital and labour ( $\sigma$ ) need not be constant. Education, organisational change, and regulatory flexibility can alter the scope for factor reallocation over time. Consequently, the elasticity of substitution  $\sigma$  becomes a key structural parameter linking technological change, income distribution, and investment incentives.

This perspective provides the foundation for a structural explanation for the middle-income trap. In poor economies, capital scarcity sustains high returns regardless of  $\sigma$ . In rich economies, sustained innovation and skill upgrading maintain high elasticity of substitution as capital deepens. Middle-income economies lie between these regimes: capital accumulation outpaces the evolution of reallocation capacity, depressing profitability and slowing growth.

### 2.4. Adjustment regimes and hypotheses

The CES production function describes the potential for economic development. However, the technological potential alone does not determine outcomes. It is a necessary, not a sufficient condition for economic growth. Whether an economy reaches its production possibility frontier depends on how distributional pressures are resolved. I model income distribution by wage and price setting à la Blanchard (1986) and describe the adjustment regime by an Adjustment Share Index (ASI), defined as the fraction of distributional pressure absorbed through real rather than nominal adjustment. While  $\sigma$  governs the curvature of isoquants in the CES production function - that is, the technological scope for substitution - ASI determines the degree of real versus nominal adjustment. The wedge between nominal income claims and technologically determined costs of production is closed by changing wages and prices or by adjustment through productivity, employment, or factor reallocation. We shall see that nominal adjustment dominates in economies lacking a credible macroeconomic anchor for price stability. Profitability and economic growth are then volatile. In rich economies, price stability blocks nominal adjustment, and the economy responds by changing employment and productivity. Middle-income countries are caught between the two dynamics.

I test three hypotheses. (H1) In poor economies, nominal adjustment is weakly constrained; macroeconomic policies are loose. Distributional pressures are absorbed through nominal adjustment of wages and prices. Given the complementarity of capital and labour, capital accumulation improves productivity, and the elasticity  $\sigma$  has limited explanatory power for the return on capital, although profitability still affects investment. (H2) In middle-income economies, nominal constraints tighten - reducing inflation - while technology is not flexible enough to expand productive capacities. Productivity gains remain limited, producing a flexibility deficit that depresses profitability as capital deepens. (H3) In rich economies capital abundance dominates and substitution gains raise productivity. Institutions mature and nominal anchors strengthen, activating real adjustment to nominal shocks. This stabilises profitability and sustains growth, provided adjustment does not increase underemployment.<sup>2</sup> In middle-income countries growth is sustained only if  $\sigma$  rises at exactly the right pace relative to capital deepening, *and* nominal adjustment is constrained enough to force real reallocation. This narrow alignment is the knife-edge of their economic development.

### 3. A formal model

I use the CES production function to model the technological supply side, which determines the production possibility frontier. I will then connect this with the nominal price and wage setting dynamics in the factor market which realises this potential.

#### 3.1. Income creation: the CES Production function

Income creation is described by the CES production function:

$$(1) \quad Y = A \left[ a(E_L L)^{\frac{\sigma-1}{\sigma}} + (1-a)(E_K K)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

Where  $A$  is Hicks-neutral total factor productivity (TFP). Because TFP accounts for all growth that cannot be attributed to labour and capital inputs, Abramovitz (1956) famously called it a "measure of our ignorance". In profit decompositions, we shall see below, this index often turns negative, measuring aggregate inefficiency.  $a$  and  $1 - a$  are technological factor weights, which measure the long-run or neutral contribution of labour and capital to output. They are deep technological parameters reflecting the underlying production structure of the economy. In the Cobb-Douglas production function, they equal the wage and profit shares, in the CES function they diverge.

$E_L$  and  $E_K$  are labour-augmenting and capital-augmenting technology. When one factor's marginal productivity changes relative to the other, technological bias "augments" that factor (Acemoglu, 2009). Booms and busts generate short term shifts, but in the long run better education systems raise labour's marginal productivity and ICT investment raises capital's

<sup>2</sup> In advanced economies this means that the Phillips curve is flat.

marginal productivity. The factor  $E_L L = H$  represents accumulated human capital (Mankiw, Romer, & Weil, 1992, p. 409), and  $E_K K$  measures capital with embodied technical change (Acemoglu, 2002).

We define the capital-labour ratio as:

$$(2) \quad k \equiv \frac{K}{L}; \quad B \equiv \frac{E_K K}{E_L L} \quad \text{and} \quad x \equiv \frac{E_K K}{E_L L} = Bk$$

$k$  is the ratio of physical capital per worker after abstraction from technological bias.  $B$  is the technological bias, and  $x$  is the effective capital-labour ratio. For lack of consistent proxy indicators in our 14-country panel I will assume in the empirical part that  $B = 1$ , and I normalise these indicators relative to the average of our 14 countries to make them comparable (Klump, McAdam, & Willman, 2011). When the stock of capital grows faster than the labour force, capital deepens; when  $x \equiv \frac{E_K K}{E_L L}$  increases, effective capital deepens.

$\sigma$  is the elasticity of substitution between capital and labour and measures technological flexibility. Geometrically, it governs the curvature of the production function and thus determines whether capital accumulation raises output through complementarity with labour or merely reallocates production through factor substitution, with fundamentally different implications for productivity and the return on capital. When the elasticity of substitution equals unity, the CES aggregator (see equation (4) below) becomes constant in intensive form, so output per worker is independent of the capital-labour ratio and the curvature channel linking capital deepening to productivity disappears.

At the firm level,  $\sigma$  determines how easily firms can shift capital and labour towards their highest-value uses. The Leontief production function represents the extreme case where  $\sigma = 0$ . Capital and labour must be used in fixed proportions. No substitution is possible. When  $\sigma < 1$ , technological complementarities dominate, and substitution is difficult. The Cobb-Douglas case emerges when  $\sigma = 1$ . Factors trade off one-to-one and technical coefficients determine factor income. When  $\sigma > 1$ , substitution becomes flexible. Firms can easily adjust their factor intensity in response to changes in wage and profit shares, thereby modifying marginal productivities and costs. In the aggregate production function,  $\sigma$  interacts with institutional flexibility which depends on the political and social environment as well as macroeconomic stability.

Yet,  $\sigma$  varies dramatically across time and countries. Assuming constant elasticity, as the standard CES production function does, therefore misspecifies production structure and biases decompositions of the net return on capital (ROC). The flexible time-varying  $\sigma$  specification avoids this error.

While  $\sigma$  measures how flexibly an economy responds to changes in capital intensity, economic development requires effective capital deepening, i.e., the steady increase of  $x$ . I define three

regimes of development. In poor economies, capital is scarce and labour is abundant, so that  $x < 1$ . In rich countries capital is abundant and labour is scarce, so that  $x > 1$ . They are capital intensive. Middle income countries have a capital/labour ration in a narrow band around or below  $x \approx 1$ .

To keep things neat, we transform equation (1) into (3). We use the effective capital–labour ratio (2) and formulate the CES aggregator  $F(x)$  which expresses the normalised effective input mix and combines capital and labour in CES form. The aggregator weights the contributions of capital and labour inputs and drives both labour and capital productivity. This makes it central to the analysis below. We get:

$$(3) \quad Y = AH [a + (1 - a)x^{\frac{\sigma-1}{\sigma}}]^{\sigma/\sigma-1} = AH [F(x)]^{\sigma/\sigma-1}$$

Where the aggregator stands for the square bracket:

$$(4) \quad F(x) = a + (1 - a)x^{\frac{\sigma-1}{\sigma}}$$

The curvature of the CES aggregator  $F(x)$ , governed by the elasticity of substitution, determines whether capital deepening raises output through productivity-enhancing complementarity or merely reallocates production via substitution, thereby shaping labour productivity, capital productivity, and the rate of profit.

We observe two important features. First, the value of  $F(x)$  is always positive but its value is inverted when  $x$  is below or above 1. It also depends on  $\sigma$ , i.e. the elasticity of substitution between labour and capital. See Table 1. For future reference, we also note that for  $x > 1$  we get  $\ln F(x) > 0$ , but for  $x < 1$  we get  $\ln F(x) < 0$ .

Table 1.<sup>3</sup>

<i>The value of F(x)</i>			
<b>L and K:</b>	<b>complements</b>	<b>balanced</b>	<b>substitutable</b>
	$\sigma < 1$	$\sigma = 1$	$\sigma > 1$
<b>Economy:</b>	<b>rigid</b>	<b>Cobb Douglas</b>	<b>flexible</b>
<b>Poor (x&lt;1)</b>	<b>high: F(x)&gt;1</b>	$F(x)=1$	<b>low: ( F(x)&lt;1</b>
	$\ln F(x)>0$	$\ln F(x)=0$	$\ln F(x)<0$
<b>balanced (x=1)</b>	$F(x)=1$	$F(x)=1$	$F(x)=1$
	$\ln F(x)=0$	$\ln F(x)=0$	$\ln F(x)=0$
<b>Rich (x&gt;1)</b>	<b>low: F(x)&lt;1</b>	$F(x)=1$	<b>high: F(x)&gt;1</b>
	$\ln F(x)<0$	$\ln F(x)=0$	$\ln F(x)>0$

Table 1 indicates that greater technological flexibility  $\sigma$  is not universally growth-enhancing: its effect depends jointly on the capital-labour ratio and on whether the economy lies in a rigid Cobb-Douglas or in a flexible CES regime.

Second, the dynamics change with  $x$  and  $\sigma$ . The elasticity of the core function  $F(x)$  is:<sup>4</sup>

$$(5) \quad \theta(x) = \frac{\partial \ln F(x)}{\partial \ln x} = \frac{(1-a) \frac{\sigma-1}{\sigma} x^{\frac{\sigma-1}{\sigma}}}{F(x)} = \frac{\sigma-1}{\sigma} s_{\pi}(x, \sigma).$$

$$\theta(\sigma) = \frac{\partial \ln F(x)}{\partial \sigma} = \frac{1-a}{F(x)} x^{\frac{\sigma-1}{\sigma}} \frac{\ln x}{\sigma^2}$$

which implies that the sign of  $\theta(x)$  depends on the size of  $\sigma$ . In rigid economies ( $\sigma < 1$ ),  $\theta(x) > 0$ , and in flexible economies ( $\sigma > 1$ ),  $\theta(x) < 0$ . The sign of  $\theta(\sigma)$  depends on the capital intensity; it is negative for  $x < 1$ , zero at  $x = 1$ , positive for  $x > 1$ .

By taking logs and first differences of (1) we get the economic growth rate for a discrete-time approximation:

$$(6) \quad \Delta \ln Y_t \approx \Delta \ln A_t + \Delta \ln H_t + s_{\pi, t-1} \Delta \ln x_t + \left[ \frac{s_{\pi, t-1} \ln x_{t-1}}{\sigma_{t-1}(\sigma_{t-1}-1)} - \frac{\ln F_{t-1}}{(\sigma_{t-1}-1)^2} \right] \Delta \sigma_t$$

<sup>3</sup> File: F\_x Table high low

<sup>4</sup> In anticipation of our later discussion of profit shares, I refer to equation (18) which defines the profit share at a given level of  $x$ :  $s_{\pi}(x) \equiv \frac{(1-a)x^{\frac{\sigma-1}{\sigma}}}{F(x)}$ .

the coefficient on  $\Delta \ln x_t$  collapses to the profit share  $s_{\pi,t-1}$ , and the  $\sigma$ -term represents changes in technological flexibility that affect output growth through two channels: the effect of  $\sigma$  on the exponent inside  $x^{(\sigma-1)/\sigma}$  (the  $s_{\pi} \ln x$  term), and the effect of  $\sigma$  on the outer CES curvature  $\sigma/(\sigma-1)$  the  $(-\ln F/(\sigma-1)^2)$  term).

The bracket describes the marginal effect of raising technological flexibility  $\sigma$  on  $\ln Y$ , evaluated at last period's  $(x, F)$ . Table 1 is a sign-map for the two ingredients inside that bracket:  $\ln x$  and  $\ln F(x)$ .

### 3.2. Productivity

Labour and capital productivity drive economic development through interdependent mechanisms. Labour productivity determines real wages and living standards. Capital productivity determines the net return on capital and investment incentives which lead to economic growth. Both mechanisms operate as a system: the real wage equals labour productivity times the wage share ( $s_w$ ); the return on capital equals capital productivity times the profit share  $s_{\pi} = (1 - s_w)$ . Higher wage shares directly reduce profit shares.

What determines productivity is therefore crucial for competitiveness and growth. Dividing equation (3) by labour or capital and given (2) and (4) yields:

Labour productivity:

$$(7) \quad \lambda = \frac{Y}{L} = AE_L [F(x)]^{\sigma/(\sigma-1)}$$

Capital productivity:

$$(8) \quad \kappa = \frac{Y}{K} = AE_K \frac{1}{x} [F(x)]^{\sigma/(\sigma-1)}$$

Both productivities increase with Hicks-neutral efficiency ( $A$ ). Labour productivity rises with labour-biased technology ( $E_L$ ) and capital productivity rises with capital-biased technology ( $E_K$ ). But capital deepening affects them oppositely: more effective capital per worker raises labour productivity whilst reducing capital productivity. This inversion generates regime-dependent effects. The capital intensity ratio  $x$  inverts at unity. The elasticity of substitution  $\sigma$  therefore affects productivity differently at each stage. See Table 1. Middle-income countries must navigate both regimes as they cross the threshold. This mechanism makes the transition from poor to rich countries fragile.

Our decomposition highlights a central asymmetry. Common technology or structural improvements raise both labour and capital productivity, while capital deepening increases labour productivity but mechanically reduces capital productivity. The elasticity of substitution  $\sigma$  governs how strongly this trade-off operates and therefore plays a key role in

shaping the technological path of returns on capital and real wages over the development process.

The implications are important. In poor economies ( $x < 1$ ), low  $\sigma$  supports growth (see Figure 1). When factors are complements ( $\sigma < 1$ ), investment equips workers with tools and raises labour productivity technologically. Abundant labour keeps capital's marginal product high, so capital productivity falls slowly despite accumulation (Figure 2). In these economies, high  $\sigma$  proves counterproductive: premature substitutability allows capital to displace labour before enough capital accumulates to equip the entire workforce productively.

In rich economies ( $x > 1$ ), the mechanism reverses. High  $\sigma$  supports growth: flexibility allows firms to reorganise production continuously, substituting abundant capital for scarce labour whilst maintaining efficiency. Labour productivity grows rapidly as capital productivity declines slowly. Low  $\sigma$  proves problematic: rigidity prevents efficient deployment of abundant capital, causing productivity to fall as the capital stock grows (Klump & Preissler, 2000) (Mallick, 2012) (Acemoglu, 2002).

In middle-income countries, optimal  $\sigma$  flips as  $x$  crosses unity. The transition requires shifting from complement-based to substitution-based production precisely when capital scarcity ends. Thus, countries fall into the trap when effective technological flexibility lags capital accumulation. Early success through complementarity—investment equips workers with more tools and raises productivity—creates the conditions for later failure. Once capital becomes abundant, rigid production structures prove counterproductive: firms cannot reorganise to substitute capital for labour efficiently.

This timing gap explains the trap. Poor countries need capital with rigid structures. Rich countries need capital with flexible technology combined with price stability. Middle-income countries must transform from one regime to the other. Investment always matters—but what makes investment attractive depends on competitiveness and the distribution of income.

The knife-edge emerges from the sign of the marginal effect of flexibility on capital productivity. Formally, we describe it by taking logs of capital productivity and differentiating with respect to  $\sigma$ :

$$(9) \quad \frac{\partial \ln \kappa}{\partial \sigma} = \frac{\partial \ln F(x, \sigma)}{\partial \sigma} - \frac{1}{(\sigma-1)^2} \ln F(x, \sigma)$$

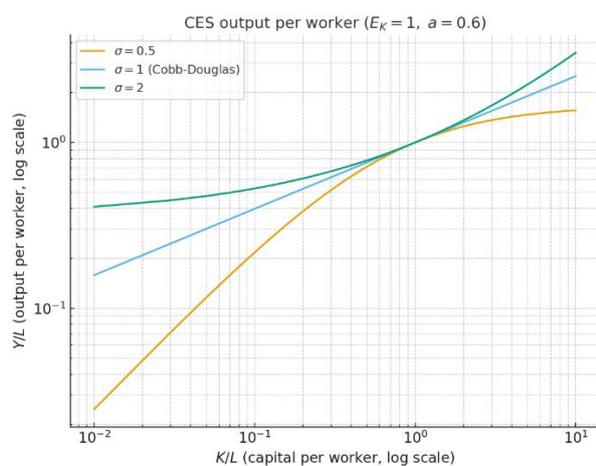
This expression changes sign depending on the level of  $x = K/L$ , the level of  $\sigma$ , and whether reallocation gains dominate curvature rents. The knife-edge condition is defined by:

$$(10) \quad \frac{\partial \ln \kappa}{\partial \sigma} = 0$$

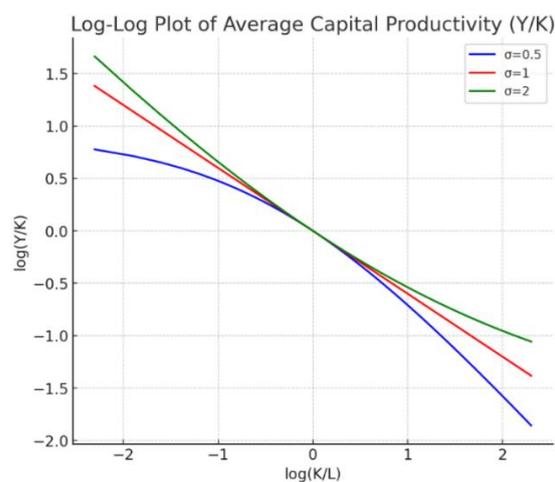
which implies that Reallocation gains = Curvature rents. Increasing  $\sigma$  neither raises nor lowers capital productivity. ROC is locally flat with respect to flexibility and small deviations in either direction reduce competitiveness. This condition typically occurs around:  $x \approx 1$  and  $\sigma \approx 1$ , which is exactly the middle-income region.

However, at any point in time, the capital-labour ratio and the elasticity of substitution define a production possibility frontier. Wages, prices, employment, and productivity growth are adjustment variables that reconcile distributional claims with this frontier. Crucially, cost pressures must drive productivity gains rather than price and wage adjustments. Flexible nominal prices or wages allow firms to avoid structural transformation: the substitution-based production regime never activates, and growth stagnates (unless exogenous TFP is high). By contrast, when prices are stable and the distribution of income changes because firms need higher profit markups or nominal wages are pushed up, firms respond by increasing productivity and/or lowering employment. Macroeconomic stability therefore becomes essential for development.

**Figure 1. Labour productivity**



**Figure 2. Capital productivity**



### 3.3. Income distribution: wage and price setting

Labour and capital productivity are connected through income distribution. The profit share and capital productivity determine the net return on capital, driving investment and accumulation. The wage share and labour productivity determine real wages and living standards. Wage and price setting establishes nominal income claims—labour costs and profit markups. When these claims diverge from what productivity supports, adjustment occurs through either nominal price and wage changes or real changes in employment and productivity.

The wage share equals total labour compensation divided by GDP; the profit share is the residual (abstracting from taxes and depreciation). This measurement framework allows me to model income distribution through the wage and price-setting process. Following Blanchard (1986), firms set prices as a markup over unit labour costs.

Unit Labour cost (ULC) are

$$(11) \quad ULC = \frac{wL}{y} = \frac{w}{\lambda}$$

The price-setting equation is then

$$(12) \quad P = (1 + m)ULC = (1 + m)\frac{wL}{Y} = (1 + m)\frac{w}{\lambda}$$

The markup  $m$  consists of the rental price of capital which is equivalent to the marginal product of capital plus an extra margin that covers oligopolistic rents and other exogenous factors such as risk premia. Market power introduces a wedge between factor shares and technological parameters. When firms exercise oligopolistic pricing power, they appropriate part of labour's marginal product as rents. To keep things simple, our markup  $(1 + m)$  amalgamates these factors. Therefore the price-setting real wage is:

$$(13) \quad \frac{w^{PS}}{P} = \frac{\lambda}{1+m}$$

Workers target nominal wages relative to expected prices and their desired real wages, as well as the rate of underemployment  $u_t$ :

$$(14) \quad \left(\frac{W}{P}\right)^{WS} = f(1 - u, z)$$

with  $f_u < 0$ , and some institutional wage-push factors (minimum wage, benefits, bargaining power, etc.)  $z_t$  (with  $f_z > 0$ ).  $u_t$  is the rate of underemployment which in developing countries primarily occurs in and through the informal sector (Fields, 1975) or in low productivity agricultural sectors (Lewis, 1954) (McMillan, 2011). Equation (12) therefore describes the Philips curve in a less developed countries system.

The interaction between wage and price setters determines the nominal equilibrium in the labour market. Assuming rational expectations, we have the market-determined equilibrium real wage

$$(15) \quad \left(\frac{W}{P}\right)^* = \frac{\lambda}{(1+m)}$$

This equilibrium real wage is equal to the price setting wage because the equilibrium underemployment rate solves for  $u^*$

$$(16) \quad f(1 - u^*, z) = \frac{\lambda}{1+m} \quad \text{with} \quad f_u \equiv \frac{\partial f(u_t, z_t)}{\partial u_t} < 0; \quad f_m \equiv \frac{\partial u_t}{\partial m_t} = \frac{-\frac{1}{(1+m_t)^2}}{f_u} > 0$$

Real wages increase with labour productivity but remain suppressed in countries with rent-seeking, monopolistic competition, and high underemployment. High worker bargaining power raises wage floors but also creates underemployment. In less developed countries, low job mobility reinforces this pattern: high-paid jobs go to workers with tertiary education whilst other workers face limited employment opportunities. More importantly, volatile labour markets generate volatility in the capital-labour ratio, creating uncertainty in returns on capital and slowing growth.

Bargaining structures, labour regulations, and competition policies determine the distribution between wages and profits which is measured by the wage and profit share. In perfectly competitive markets, factors receive their marginal products—the real wage equals MPL and the return on capital equals MPK. But in the CES framework, institutional wage-setting and mark-ups sever this link: factor income shares diverge from marginal products.

The market-based wage and profit shares are derived from equations (9), and (10). The market-determined wage share is:

$$(17) \quad s_w = \frac{ULC}{P} = \frac{1}{1+m}$$

And the market-determined profit share is

$$(18) \quad s_\pi = \frac{m}{1+m} = (1 - s_w)$$

These equations establish the partial equilibrium in the labour market as a result of nominal wage and price setting. However, the general equilibrium in the economy requires that the labour market equilibrium is consistent with the production system. The CES production function links feasible income shares to technology and describes how firms combine capital and labour. Blanchard's nominal wage-price markup becomes a real distributive parameter in the CES setting, shaping the wage share, the profit share, and ultimately the dynamics of  $\sigma$  and ROC. This is the conceptual bridge between institutional wage-price setting and the activation of the technological flexibility channel in my model. The markup pins down a targeted wage share, the CES function pins down a feasible wage share. In general equilibrium the two must be equal. The feasible income shares are:

Technological wage share:

$$(19) \quad s_w = \frac{a}{a+(1-a)x^{\sigma-1/\sigma}} = \frac{a}{F(x)}$$

Technological profit share:

$$(20) \quad s_{\pi} = (1 - s_w) = \frac{(1-a)x^{\sigma-1/\sigma}}{a+(1-a)x^{\sigma-1/\sigma}} = \frac{(1-a)x^{\sigma-1/\sigma}}{F(x)}$$

These formulas reveal a non-monotonic pattern that depends on the capital/labour ratio. In poor, rigid economies ( $x < 1$ , low  $\sigma$ ), capital scarcity and low wages generate high profit shares. In rich, flexible economies ( $x > 1$ , high  $\sigma$ ) profit shares can be also high despite diminishing returns due to high productivity and efficient substitution. Between these extremes, mismatched regimes produce lower profit shares. Poor economies with premature flexibility and rich economies with persistent rigidity both suffer when factor payments fail to align with productivity. The condition for the general equilibrium wage share is therefore:

$$(21) \quad s_w^* = \frac{1}{1+m} = \frac{a}{a+(1-a)x^{\frac{\sigma-1}{\sigma}}}$$

A positive wedge between market and technologically determined income shares generates pressure on profitability. The wedge can be caused by a wage shock through the z-factor in equation (12) or by an increase in the targeted markup. The effect is the same: either shock triggers an adjustment process either through nominal or real variables. Firms respond through substitution, technological change, or income redistribution. Depending on the institutional setups, the adjustments are bi-directional as my estimated VAR system will show below.

### 3.4. The net return on capital

Our measure for competitiveness, the net return on capital, is the profit share multiplied by capital productivity. Given equation (8) and (16) we get:

$$(22) \quad ROC = \frac{Y}{K} s_{\pi} = E_K \frac{1}{x} [F(x, \sigma)]^{\frac{\sigma}{\sigma-1}} \frac{m}{1+m}$$

Taking logs and first differences, we obtain the growth rate of profits as a function of Hicks-neutral progress, capital improvements, capital accumulation (we assume for simplicity  $x = K/L$ ), and the markup in (18):

$$(23) \quad \ln ROC = \ln A + \ln E_K - \ln x + \frac{\sigma}{\sigma-1} \ln F(x, \sigma) + \ln s_{\pi}(m)$$

$$(24) \quad \Delta \ln ROC = \Delta \ln A + \Delta \ln E_K - \Delta \ln x + \Delta \left[ \frac{\sigma}{\sigma-1} \ln F(x, \sigma) \right] + \Delta \ln s_{\pi}(m)$$

The effects of  $\Delta \ln ROC = \Delta \ln A + \Delta \ln E_K - \Delta \ln x + \Delta \ln s_{\pi}(m)$  are straight forward. The factor  $\Delta \left[ \frac{\sigma}{\sigma-1} \ln F(x, \sigma) \right]$  in (22) represents the elasticity of the profit rate with respect to the

technological state of the economy, conditional on real adjustment being activated. It can be further reduced to (see Appendix B)<sup>5</sup>:

$$(25) \quad \Delta \ln ROC = \Delta \ln A + \Delta \ln E_K + (s_\pi - 1) \Delta \ln x + \left[ \frac{\sigma}{\sigma-1} \theta_\sigma - \frac{\ln F(x, \sigma)}{(\sigma-1)^2} \right] \Delta \sigma + \Delta \ln s_\pi(m)$$

This equation decomposes changes in competitiveness into five economically distinct adjustment channels. Exogenous efficiency ( $\Delta \ln A + \Delta \ln E_K$ ) depends on Hicks-neutral and capital-augmenting progress. It raises capital intensity mechanically and therefore raises ROC one-for-one. Thus, better technology or better capital quality increases the return on capital. Holding technology fixed, capital deepening  $(s_\pi - 1) \Delta \ln x$  lowers profitability in line with standard diminishing returns: more capital per worker lowers capital productivity. The distributional effect is caught by the markup  $\Delta \ln s_\pi(m)$

This captures nominal and institutional adjustment. Higher markups (or weaker wage bargaining) raise the profit share and therefore raise ROC directly. This is not technological; it is redistribution.

Technological flexibility is represented by the  $\sigma$ -channel  $\left[ \frac{\sigma}{\sigma-1} \theta_\sigma - \frac{\ln F(x, \sigma)}{(\sigma-1)^2} \right] \Delta \sigma$ . The first component  $\left( \frac{\sigma}{\sigma-1} \theta_\sigma \right)$  captures how changes in  $\sigma$  alter the composition of production (how easily capital substitutes for labour). According to equation (5), the sign of this component switches according to the state of technological flexibility and the capital intensity of the economy.

In a CES production structure, technological flexibility  $\Delta \sigma$  has an ambiguous effect on capital productivity. An increase in the elasticity of substitution  $\sigma$  improves factor reallocation by allowing capital and labour to substitute more easily, but it simultaneously erodes the curvature rents generated by complementarity in production. The net effect of flexibility is therefore governed by the response of the CES amplification term  $\sigma/(\sigma-1) \ln F(x, \sigma)$  to changes in  $\sigma$  (the bracketed term in (22)).

When the marginal reallocation gains from higher  $\sigma$  dominate the curvature loss, flexibility raises capital productivity and the return on capital. When curvature rents dominate, higher  $\sigma$  reduces capital productivity by generating premature substitution of labour for capital. The sign of this effect depends on the economy's position along the development path: In capital-scarce economies, low  $\sigma$  preserves complementarity between capital and labour, so moderate increases in flexibility enhance productivity without displacing labour. In middle-income economies, rising  $\sigma$  often precedes sufficient capital deepening and operates through labour displacement or nominal adjustment, reducing capital productivity and generating a middle-income trap. In capital-abundant economies,

<sup>5</sup> File Equation 23.docx

high  $\sigma$  becomes essential to sustain returns on capital, as productivity growth increasingly relies on substitution under nominal rigidities.

Technological flexibility is therefore not uniformly growth-enhancing: it raises capital productivity only when aligned with the economy's factor endowment and its institutional capacity for real adjustment.

### 3.5. Competitiveness and economic development

Economic growth in this framework is governed by the evolution of the net return on capital. ROC determines investment incentives, capital accumulation, and hence the path of output per capita. Technological flexibility and adjustment regimes affect growth only insofar as they stabilise or raise the return on capital.

We can now relate the three development regimes to the middle-income trap. In poor economies, capital is scarce and labour abundant. Hence, the marginal product of capital, and therefore ROC, are high. Under these conditions, a low elasticity of substitution favours growth. When  $\sigma$  is low, capital and labour are complements and must be used jointly. Capital accumulation therefore raises labour productivity by equipping workers with tools they previously lacked. Because labour is abundant, new capital can be employed without displacing workers, sustaining high marginal products of capital as the capital stock expands.

This mechanism weakens if substitution is activated too early. When effective flexibility - defined as technological substitutability filtered through the adjustment regime - allows capital to replace labour before sufficient capital has accumulated, capital is deployed to economise on labour rather than to complement it. Productivity gains weaken, capital is used inefficiently, and the marginal product of capital declines.

In rich economies, the logic is reversed. Labour becomes scarce, and high  $\sigma$  is essential for maintaining returns on capital. Technological substitutability allows firms to reorganise production efficiently, replacing labour with capital as relative factor prices change. Capital accumulation can therefore proceed without a sharp decline in marginal productivity. When  $\sigma$  is low, by contrast, rigid production structures prevent such reorganisation. Additional capital produces little extra output because it lacks complementary labour, causing the return on capital to fall sharply.

Middle-income economies face a particularly delicate transition. As the capital-labour ratio approaches unity, production shifts from labour-abundant to capital-abundant regimes. Capital accumulation remains necessary but is no longer sufficient for sustained growth. Without a timely increase in effective flexibility, additional capital cannot be deployed profitably and returns decline. At the same time, if substitution is activated prematurely, capital displaces labour before complementary scale has been reached, again depressing marginal productivity. The transition therefore requires a narrow and difficult reconfiguration from complementarity-based to substitution-based production.

However, this is only one part of the story.  $\sigma$  defines the technological production possibility frontier. Whether this potential is realised depends on the mode of adjustment when the economy is out of equilibrium. With nominal adjustment dominating—through flexible prices and wages—the economy converges to a wage share consistent with the existing production structure, generating little pressure for productivity-enhancing reallocation. In this case, the Adjustment Share Index (ASI), which I will describe below, is low; *effective* flexibility remains limited, and the return on capital declines as accumulation proceeds. Even improvements in  $\sigma$  and higher capacities do not prevent stagnation if real adjustment is not activated.

The middle-income trap therefore reflects a failure to activate technological flexibility through real adjustment at the appropriate stage of development. Institutional and technological flexibility must rise synchronously with capital accumulation, yet the window for doing so is narrow. Countries must activate substitution precisely as factor endowments shift—neither too early nor too late. The implication is that  $\sigma$  does not enter the growth equation directly. Its effect is mediated entirely through ROC.  $\sigma$  must be absorbed by the adjustment regime and therefore has no independent marginal effect on growth.

This hierarchical structure - in which  $\sigma$  affects growth only through its impact on ROC, conditional on the adjustment regime - guides the econometric strategy below. I will test these predictions using time-varying estimates of technological flexibility, regime-specific ROC regressions, and VAR-based measures of nominal versus real adjustment.

## 4. Descriptive Empirical Evidence from Fourteen Asian Economies

I now present empirical evidence for the variables identified by the theoretical part. I proceed in three stages. First, I document descriptive patterns for capital deepening, ROC, time-varying  $\sigma$ , and wage shares to document heterogeneity across East and Southeast Asia and identify stages of development. Second, I estimate a Vector Autoregressive model for wage bargaining to assess the impact for nominal versus real adjustment. Third, panel regressions measure the impact of flexibility on competitiveness (the flexibility channel) and of competitiveness on economic growth (the competitiveness channels). To evaluate causality, I will check the robustness of these channels.

### 4.1. The data

The descriptive evidence across East and Southeast Asia reveals significant heterogeneity. Table 2 presents World Bank data for GDP per capital in constant international dollars for a selection of countries. According to this classification, even Japan and Euroland are not high-income countries, although the USA, Singapore, and Brunei are. I will work with a full panel comprising 14 economies: ASEAN 10 plus China, Korea, Taiwan and Japan. Myanmar, Laos and Cambodia are clearly low-income countries. The Philippines, Vietnam and Indonesia are lower middle-income, and Thailand, Malaysia and China are upper middle-income. However, their gap with Japan and Korea is sufficiently large to keep them in the middle-income group and to put Japan

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and Korea into the rich country group. I therefore concentrate on three subpanels: Poor countries (Myanmar, Laos, Cambodia), middle-income countries (Thailand, Vietnam, Malaysia, Indonesia, Philippines, China), and rich countries (Singapore, Brunei, Taiwan, Korea, Japan). This classification is also validated by data on the capital-labour ratio which I discuss next.

The time series of our panels are long ( $T=52$ , from 1970 to 2022), but the number of cluster members is small. The poor countries panel has only three members, the middle-income group has 6 and rich countries have 5 members. I will address the econometric implications below.

Unless indicated differently, most data used for the empirical analysis are drawn from the Asian Productivity Organisation data base.<sup>6</sup> Additional data for GDP per capita in international dollar levels, for the human development index, and for money supply were taken from the World Bank Development indicators.<sup>7</sup> Quality of government data were obtained from the World Bank Governance Indicators.<sup>8</sup> The index for Political Rights and Civil Liberties from Freedom House<sup>9</sup> was rebased into a range from zero to 1 where the higher value stands for more freedom. The full set of data variables is in the attached Appendix A excel file.

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<sup>6</sup> [APO Productivity Databook 2024 - APO](#)

<sup>7</sup> <https://databank.worldbank.org/source/world-development-indicators>

<sup>8</sup> [Home | Worldwide Governance Indicators](#)

<sup>9</sup> [Freedom House | Expanding and Defending Freedom Worldwide](#)

**Table 2.**

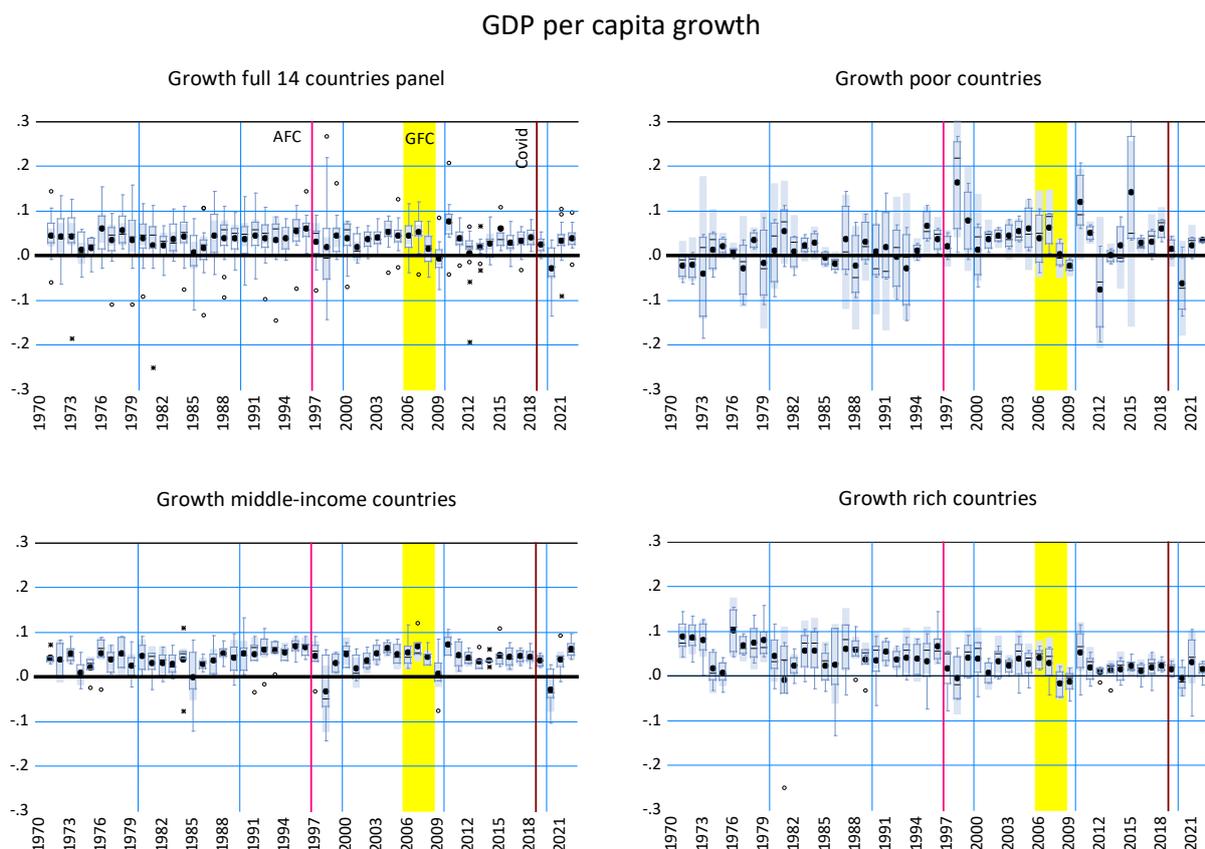
<b>GDP per capita, PPP (constant 2021 international \$)</b>				
	GDP Pc	GDP Pc	GDP Pc	GDP Pc
Country Name	1990	2000	2010	2024
<b>Low income</b>	<b>2,031</b>	<b>2,067</b>	<b>2,675</b>	<b>2,228</b>
<b>LDC (UN classification)</b>	<b>1,903</b>	<b>2,013</b>	<b>2,925</b>	<b>3,896</b>
Myanmar	775	1,360	3,894	5,276
Cambodia	2,646	1,922	3,712	7,012
Lao PDR	2,006	2,899	4,946	8,611
<b>Lower middle income</b>	<b>2,901</b>	<b>3,590</b>	<b>5,379</b>	<b>8,789</b>
India	2,203	3,100	5,059	9,817
Philippines	4,504	4,740	6,273	10,376
Viet Nam	2,468	4,349	7,275	14,415
Indonesia	4,873	6,056	8,848	14,470
<b>Middle income</b>	<b>4,573</b>	<b>5,764</b>	<b>9,174</b>	<b>14,902</b>
World	11,219	12,708	15,945	21,268
<b>Upper middle income</b>	<b>5,938</b>	<b>7,715</b>	<b>12,928</b>	<b>21,659</b>
Thailand	8,702	11,623	16,730	21,737
China	1,667	4,066	10,476	23,846
Malaysia	12,014	18,533	23,308	34,072
Japan	35,272	39,006	40,882	46,097
Korea	13,840	25,111	37,611	50,414
Euro area	37,871	45,551	49,189	56,326
<b>High income</b>	<b>34,971</b>	<b>41,003</b>	<b>47,507</b>	<b>58,151</b>
United States	44,379	55,039	59,789	75,492
Brunei Darussalam	118,164	100,323	88,587	79,184
Singapore	45,568	68,315	95,456	132,570
East Asia & Pacific (excluding high income)	2,513	4,658	9,942	20,452
East Asia & Pacific	5,743	8,249	13,604	23,954
Low & middle income	4,406	5,504	8,654	13,690
South Asia	2,221	3,098	4,998	9,653

## 4.2. The diversity of economic growth

The growth rates for GDP per capita have varied across the 14 countries in Asia over half a century. Figure 2 shows their evolution, Table 3 summarises. The boxplots summarise both the annual mean and the variance within each group and across time. The black dots indicate the group mean in each year, showing a global transition toward lower and more stable GDP per-capita growth over time, with important differences across income groups. In the full 14-country panel, the mean growth rate declines after the Asian Financial Crisis (AFC) and compresses further following the Global Financial Crisis (2007-2009) crisis. Poor countries exhibit both the highest diversity and the sharpest structural breaks, with deep contractions in the 1980s–90s and large booms in the 2000s, while volatility decreases only modestly after 2010. Middle-income countries display a relatively stable mean, interrupted by the two

financial crises and gradually declining, with a steady narrowing of the dispersion. This is consistent with the middle-income trap. Rich countries show the lowest mean and the tightest intra-group variation, with a pronounced post Global Financial Crisis drop into a persistent low-growth regime. Overall, the figure highlights a global pattern of secular growth deceleration and convergence in volatility, punctuated by a common structural break around the GFC whose severity increases with poverty.

Figure 2. <sup>10</sup>



<sup>10</sup> File: growth\_g\_growth

**Table 3.**<sup>11</sup>

	avg 70-98	stdev 70-98	avg 98-22	stdev 98-23
Laos	1.4%	0.0451	2.8%	0.0652
Myanmar	2.3%	0.0400	4.2%	0.1077
Cambodia	-1.3%	0.0817	4.5%	0.0384
Thailand	5.2%	0.0380	2.2%	0.0299
Indonesia	5.0%	0.0219	2.4%	0.0391
Philippines	1.7%	0.0432	2.9%	0.0373
Malaysia	4.7%	0.0264	3.2%	0.0429
Vietnam	3.2%	0.0366	5.7%	0.0189
China	5.1%	0.0344	6.9%	0.0230
Brunei	-0.2%	0.0848	-1.2%	0.0339
Japan	3.2%	0.0253	0.5%	0.0214
Singapore	5.8%	0.0286	3.4%	0.0413
Korea	7.7%	0.0313	3.3%	0.0293
Taiwan	7.7%	0.0376	3.6%	0.0258
poor	0.8%	0.0556	3.9%	0.0704
middle	4.2%	0.0334	3.9%	0.0319
rich	4.8%	0.0415	1.9%	0.0303

### 4.3. The distribution of income: wage shares and inflation

In our model, the distribution of income is determined by nominal wage and price setting; the real economy adjusts. I will analyse this adjustment in section 5. Here, Figure 3 indicates the evolution of wage shares (real unit labour costs) in the three blocks. Individual timeseries are shown in the Appendix C Figure C2. Three patterns stand out. In poor countries, the wage share rises just before the Asian Financial Crisis to over 50 percent and then falls to 40 percent. In middle-income countries, it is the opposite development. While they start at similar levels in the 1970s, capital accumulation continuously pushed the wage shares below 40 percent. It only slightly increased after the Global Financial Crisis. In the rich countries, income distribution is remarkably stable with a band between 40-50 percent, although Brunei is a significant outlier (see Appendix C Figure C2). The variation within the groups was significantly higher in poor and middle-income countries before the Asian crisis.

Table 4 summarises inflation and price flexibility (the standard deviation) in the three country groups. It confirms our hypothesis that the likelihood of adjustment through prices is high in poor countries and gradually decreasing for middle and rich countries.

<sup>11</sup> File: growth\_hp\_panel\_ordered

Figure 3.

### Wage Shares

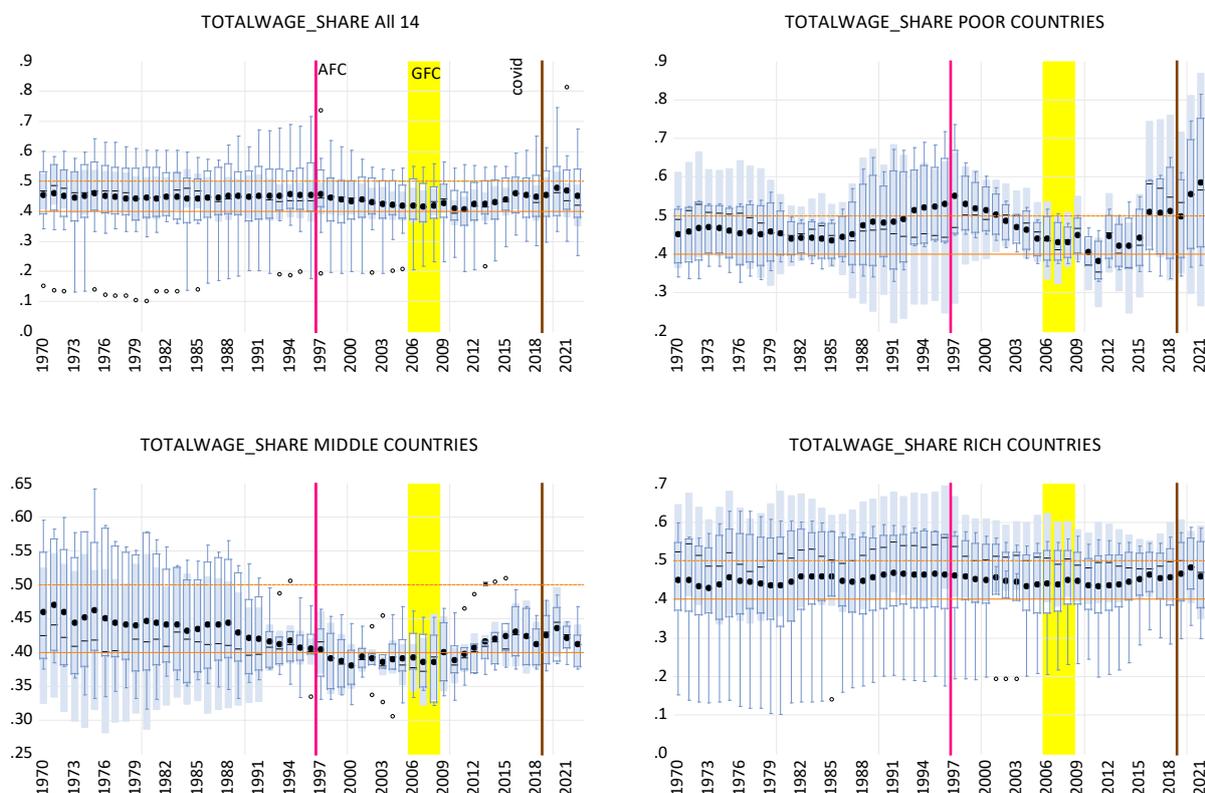


Table 4.

Inflation (change of CPI Index)	Poor countries		Middle income		Rich countries	
	1970-2022	1998-2022	1970-2022	1998-2022	1970-2022	1998-2022
Mean	0.1650	0.0995	0.0876	0.0400	0.0371	0.0118
Median	0.0738	0.0498	0.0463	0.0312	0.0198	0.0081
Maximum	1.0601	0.8260	1.7666	0.4603	0.7897	0.0724
Minimum	-0.5949	-0.0080	-0.0173	-0.0173	-0.0234	-0.0234
Std. Dev.	0.2280	0.1405	0.1809	0.0487	0.0691	0.0162
Skewness	1.5774	3.1157	6.6521	4.9506	6.1566	1.1493
Kurtosis	6.9122	14.0770	55.1215	39.7793	58.9587	4.8001
Observations	156	75	312	150	260	125

#### 4.4. Capital Intensity and the Stages of Development

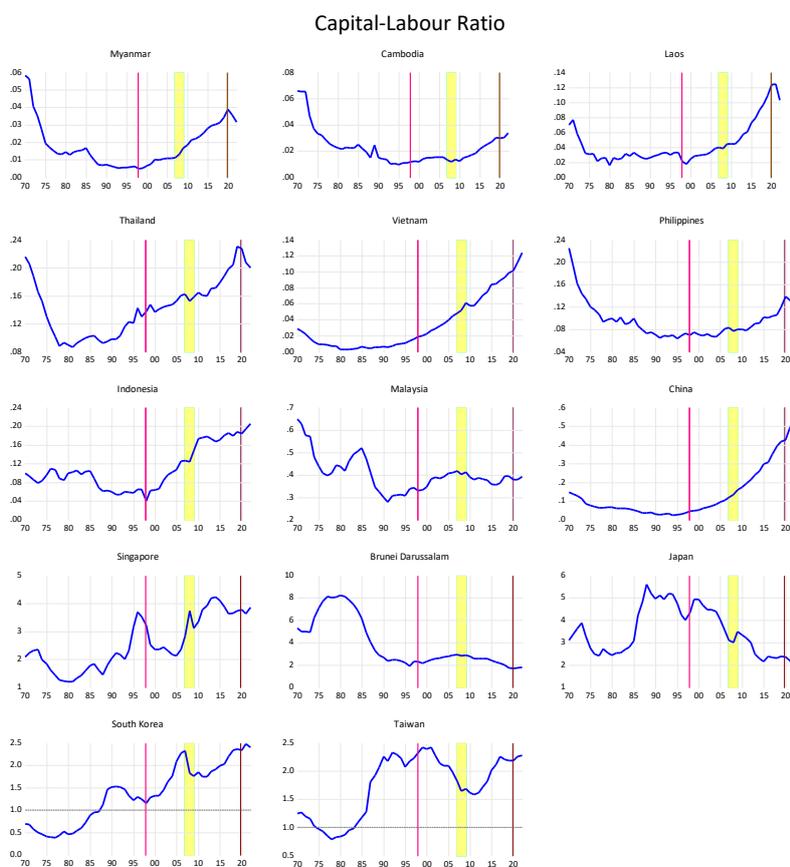
Development stages depend on the capital-labour ratio  $x$ . I index each country's capital per worker against the 14-country annual mean: values above unity indicate above-average capital intensity; values below indicate labour intensity. I focus on pure capital accumulation because indicators for capital and labour augmentation lack consistency and obscure the pattern.

Figure 4 reveals substantial and persistent cross-country variation. Three income-based clusters emerge: poor economies remain far below average, though Cambodia and Laos accelerated capital deepening after the late 1990s. High-income economies maintain permanently high capital intensity. Middle-income economies cluster near but below the panel average.

High-income Asian economies exhibit strong capital deepening. Japan gradually reduced its 1980s over-accumulation. Brunei is an outlier, reflecting oil price developments. Poor countries operate at less than 10 percent of average K/L ratios. After the Asian Financial Crisis improvements appear but remain moderate. Vietnam, China, and Laos persistently accumulate capital per worker. The original ASEAN founders maintain higher capital stocks but remain below the regional benchmark.

A structural break occurs at the Asian Financial Crisis: capital accumulation decelerates in advanced economies but accelerates in poorer ones. Middle-income performance is mixed. Thailand, Indonesia, China, and Vietnam increased capital per worker rapidly; Thailand, Malaysia, and the Philippines stagnated after the Global Financial Crisis.

Figure 4.<sup>12</sup>



<sup>12</sup> File: new sigma panels, growth, roc 2 g\_kl\_timeseries\_groups

#### 4.5. Competitiveness and the net return on capital

Our operational measure for competitiveness is the aggregate net return on capital (ROC). Figure 5 shows boxplots; Figure C1 in the Appendix documents time series.

In poor economies, ROC is high and volatile, reflecting capital scarcity and unstable macroeconomic conditions. Middle-income economies show declining returns, indicating that diminishing marginal returns are not offset by productivity gains. High-income economies exhibit low but stable profitability; Brunei, a major oil producer, is the outlier with high volatility.

ROC displays a pronounced secular decline from the 1970s, accelerating after the global financial crisis. Poor economies experience the steepest erosion, with high initial volatility giving way to chronically low returns after 1997—a structural inability to generate competitive returns under capital deepening. Middle-income economies follow a moderate trajectory with a clear 1997 break; the modest recovery of the early 2000s proves short-lived. Advanced Asian economies begin with low ROC but stabilise, with profitability remaining subdued after the global crisis.

Two major disruptions punctuate these trends: the Asian Financial Crisis (1997) and the Global Financial Crisis (2008-09). Both generate temporary synchronisation before divergence re-emerges. Figure 6 plots the annual standard deviation of returns across all fourteen countries, ASEAN-10, and ASEAN-5. Divergence rises during booms and falls after crises. The standard deviation is non-stationary, with no evidence of long-run convergence. A Pesaran CIPS panel unit root test examining whether national returns converge stochastically to the panel mean rejects convergence for all but Singapore and Korea. Persistent national frictions and domestic structural determinants dominate regional spillovers.

Capital does not flow freely to equalise returns. These economies operate far from perfect competition.

Figure 5.

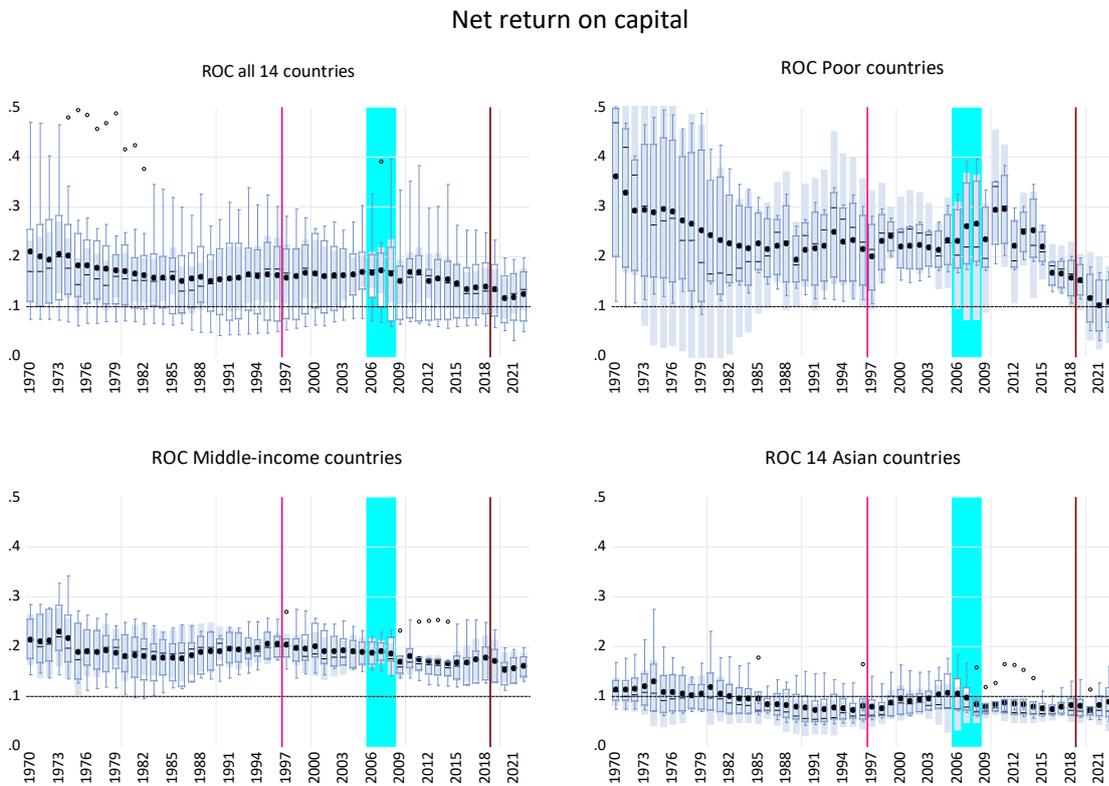
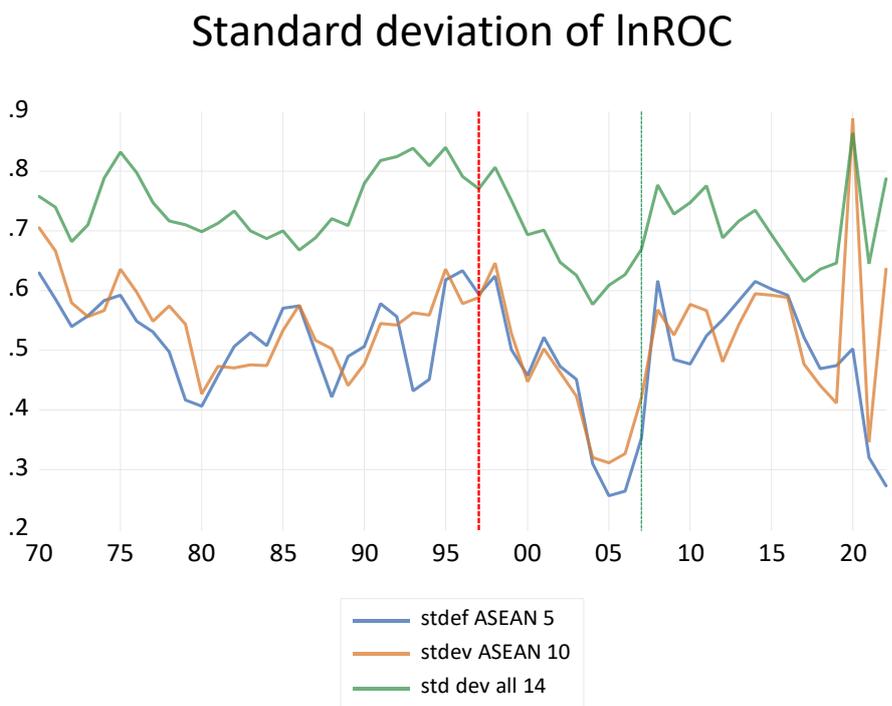


Figure 6.



#### 4.6. Time-varying Elasticity of Substitution ( $\sigma$ )

The technological elasticity of substitution  $\sigma$  measures how flexibly an economy responds to changes in capital intensity—and thus shapes economic growth when real adjustment is activated.  $\sigma$  varies dramatically across time and countries. It is a slow-moving technological parameter that evolves with capital deepening, organisational change, and production techniques. In the CES framework, a constant elasticity implies a fixed curvature of the production frontier, which is inconsistent with observed changes in factor shares, capital productivity, and wage-price dynamics over long development horizons. Assuming constant elasticity therefore misspecifies production structures and biases ROC decompositions. A flexible time-varying  $\sigma$  specification avoids this error. It prevents the misattribution of structural change to nominal shocks and yields a direct mapping between technological flexibility and observed factor-share dynamics. Treating  $\sigma$  as time-varying allows the production structure to adjust endogenously as economies move from capital scarcity to capital abundance. This is essential for identifying the non-monotonic relationship between flexibility, capital productivity, and growth that underpins the middle-income trap mechanism.

Econometric estimates of  $\sigma$  remain controversial. Whilst theory strongly supports  $\sigma$ 's importance for growth analysis, little agreement exists on empirical values (Chirinko, 2008, p. 671). Antras (2004), Chirinko, (2008) and Ialenti & Piali (2024) review a large literature estimating constant elasticities, mainly for OECD countries. Although the range is wide, most estimates fall below unity (Acemoglu, 2003). Acemoglu (2002) recognised, however, that if  $\sigma$  exceeds a threshold level, long-run relative demand for a factor can slope upward. Return on capital could then rise as capital per worker deepens. Karabarbounis and Neiman (2014) estimated  $\sigma$  in a large panel and found it exceeds unity but remains below Acemoglu's threshold. They concluded this explains falling wage shares and rising profit shares.

Few economy-wide macro estimates exist for Asia. Mallick (2012) estimates  $\sigma$  separately for 90 countries using time series from 1950–2000. Eight countries show  $\sigma > 1$ , five of them in East Asia (Hong Kong, Indonesia, Korea, Malaysia, Taiwan). Shankar and Rao (2012) estimate a CES production function with Bayesian methods to for Singapore (1960–2009) and found  $\sigma = 0.6$ . Thach (2020) estimates a variable elasticity of substitution (VES) production function for Vietnam following Revankar (1971). In VES frameworks, changes in the capital-labour ratio affect  $\sigma$ , which then feeds back into capital formation and growth. Thach tested whether Vietnam's substitution parameter varies linearly with the capital-labour ratio and found that this coefficient  $\gamma_t$ —by which  $\sigma$  exceeds unity—is a positive constant. He does not, however, report a precise value for  $\sigma$ .

Piketty (2014) and Piketty & Zucman (2014) document slow-moving structural forces in wealth accumulation, particularly the long-run rise of the wealth–income ratio. In this

framework, the elasticity of substitution  $\sigma$  is the central structural parameter that determines how an economy's distribution of income reacts when the capital-output ratio ( $K/Y$ ) rises. This motivates smooth, state-space approaches to factor dynamics, but Piketty does not estimate  $\sigma$ . Because my CES-ROC theory requires  $\sigma$  to adjust as the capital-labour ratio evolves, I measure it directly from factor shares and  $K/L$ .

Note that the capital/output ratio is the inverse of capital productivity. Piketty's analysis centres on the wealth-income ratio, which aggregates real capital with financial and non-productive assets, and therefore obscures capital productivity in a production function. My approach identifies  $\sigma$  directly from factor shares and relates it to capital productivity ( $Y/K$ ), which — together with the profit share and the activation of adjustment — is the core driver of competitiveness and growth. Because I use aggregate national accounts,  $\sigma$  captures economy-wide substitutability - an indicator of macroeconomic supply-side flexibility.

The time-varying  $\sigma_t$  is identified from the CES factor-share condition, which links the logit of the wage share to  $\log(K/L)$ . Writing

$$(26) \quad \ln \frac{s_{w,t}}{1-s_{w,t}} = c + \beta_t \ln(K/L)_t + u_t$$

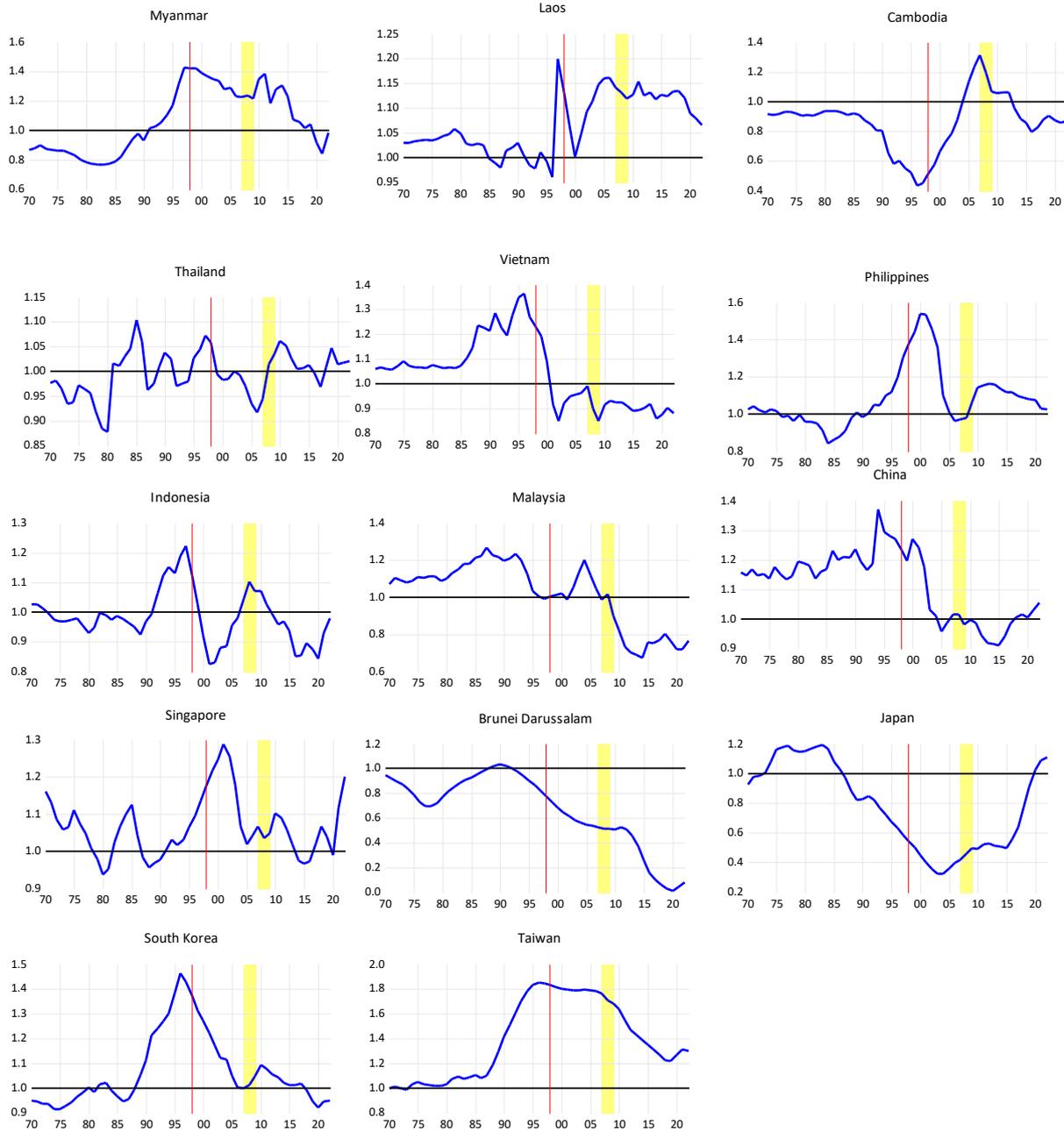
The time-varying elasticity of substitution is  $\sigma_t = 1/(1 + \beta_t)$ . This method models  $\beta_t$  as a latent state and estimates it via a Kalman filter. This "Piketty-Kalman" estimator preserves the spirit of Piketty's emphasis on slow-moving structural forces and allows me to interpret the CES production function as the production possibility frontier.

Figure 7 and Table 5 show that  $\sigma$  is neither constant nor uniform across countries: most economies experience long swings in substitutability. Poor countries display low and unstable  $\sigma$ , especially before the 2000s. Rich countries converge to smoother, higher  $\sigma$  paths. Japan is the big outlier. Episodes of rising  $\sigma$  often coincide with periods of faster capital deepening and structural change, whereas  $\sigma$ -collapses indicate phases of rigidity and slowdown. Countries escaping the middle-income trap tend to display  $\sigma$  drifting above 1, while those stuck in the trap keep  $\sigma$  below 1 with high volatility.

The regime-dependency of the elasticity of substitution is clear from Table 5 which describes the statistical distribution of  $\sigma$  values before and after the Asian Financial Crisis. Averaged over a quarter century, these values are much closer to 1. Nevertheless, the mean  $\sigma$  has improved in poor and rich countries but deteriorated in the middle-income group. Although the standard deviation has not changed significantly between the two periods skewness indicates that in most poor and middle-income countries  $\sigma$  has moved in the direction of rigidity (the exceptions are Cambodia, Thailand and Vietnam). The kurtosis reveals that  $\sigma$  has become more stable after the Asian Financial Crisis.

Figure 7.<sup>13</sup>

### Time-varying Sigma



<sup>13</sup> File: masterpage\_g\_sigma\_fig

**Table 5. Compound growth rates for sigma**

Descriptive Statistics for SIGMA										
Categorized by values of COUNTRY										
Sample: 1970 1998						Sample: 1998 2022				
Included observations: 742						Included observations: 350				
	Mean	Std. Dev.	Skew.	Kurt.	Obs.	Mean	Std. Dev.	Skew.	Kurt.	Obs.
Cambodia	0.802744	0.173662	-1.04976	2.431251	29	0.919205	0.194754	0.002454	2.746622	25
Laos	1.028263	0.04578	2.019942	8.553586	29	1.113529	0.037594	-1.29476	4.432883	25
Myanmar	0.93987	0.186051	1.442079	4.201509	29	1.21458	0.163129	-0.73896	2.538527	25
China	1.19301	0.055342	1.390284	4.787864	29	1.031898	0.105305	1.113287	3.048473	25
Indonesia	1.016809	0.079731	1.217037	3.313343	29	0.953115	0.088487	0.271749	2.012919	25
Malaysia	1.132794	0.075261	-0.12887	2.137007	29	0.886114	0.163034	0.307051	1.675972	25
Philippines	1.016443	0.11665	1.428529	5.391652	29	1.166282	0.176313	0.989429	2.707218	25
Thailand	0.991915	0.054245	-0.13716	2.660992	29	1.002389	0.036667	-0.49671	2.952621	25
Vietnam	1.144303	0.099301	0.784776	2.19885	29	0.940859	0.09493	1.979285	6.170832	25
Brunei Daru	0.880127	0.101904	-0.2938	2.029799	29	0.411801	0.243632	-0.49703	1.843328	25
Japan	0.95964	0.202271	-0.52948	2.083957	29	0.566602	0.231449	1.312806	3.543938	25
Singapore	1.048192	0.064991	0.130443	2.147411	29	1.089968	0.094817	0.650592	2.262418	25
South Korea	1.073113	0.175	1.060989	2.611701	29	1.071053	0.117356	1.132461	3.498933	25
Taiwan	1.263419	0.322135	0.920725	2.144354	29	1.563196	0.232038	-0.22248	1.340704	25
All	1.035046	0.186069	0.795491	7.214899	406	0.995042	0.305786	-0.30088	4.61151	350
Poor avg	0.923626	0.135165	0.804088	5.062115		1.082438	0.131826	-0.67709	3.239344	
Middle avg	1.030399	0.087849	0.478418	2.955274		0.893427	0.133844	0.42563	2.893815	
Rich avg	1.104943	0.187049	0.726912	3.529591		1.179815	0.187499	0.314925	2.928391	

## 5. Flexible Adjustment and Economic Development

This section estimates how flexibility contributes to economic development through two distinct channels. The flexibility channel captures how production structure and adjustment regimes shape competitiveness, while the competitiveness channel measures how profitability translates into long-run income growth.

Flexibility depends on both technological conditions, summarised by the elasticity of substitution  $\sigma$ , and on how nominal income claims are reconciled with real productive capacity. To identify this mechanism, a panel VAR is estimated that traces how nominal wage and price shocks are absorbed and propagated into labour productivity and employment. The resulting impulse responses yielded two empirical adjustment measures. The Adjustment Share Index (ASI) captures the share of real adjustment occurring through productivity rather than wages and prices, while the Productivity Share Index (PSI) captures the split of real adjustment between productivity and employment.

These measures are combined with technological flexibility to construct an effective elasticity of substitution, defined as  $\sigma^{\text{eff}} = \sigma \times \text{ASI}$ , which captures the extent to which substitution operates through real productivity adjustment rather than nominal price changes. The flexibility channel then evaluates how  $\sigma^{\text{eff}}$  affects competitiveness via the

return on capital. The competitiveness channel subsequently estimates how profitability contributes to GDP per capita growth.

### 5.1. The adjustment channels

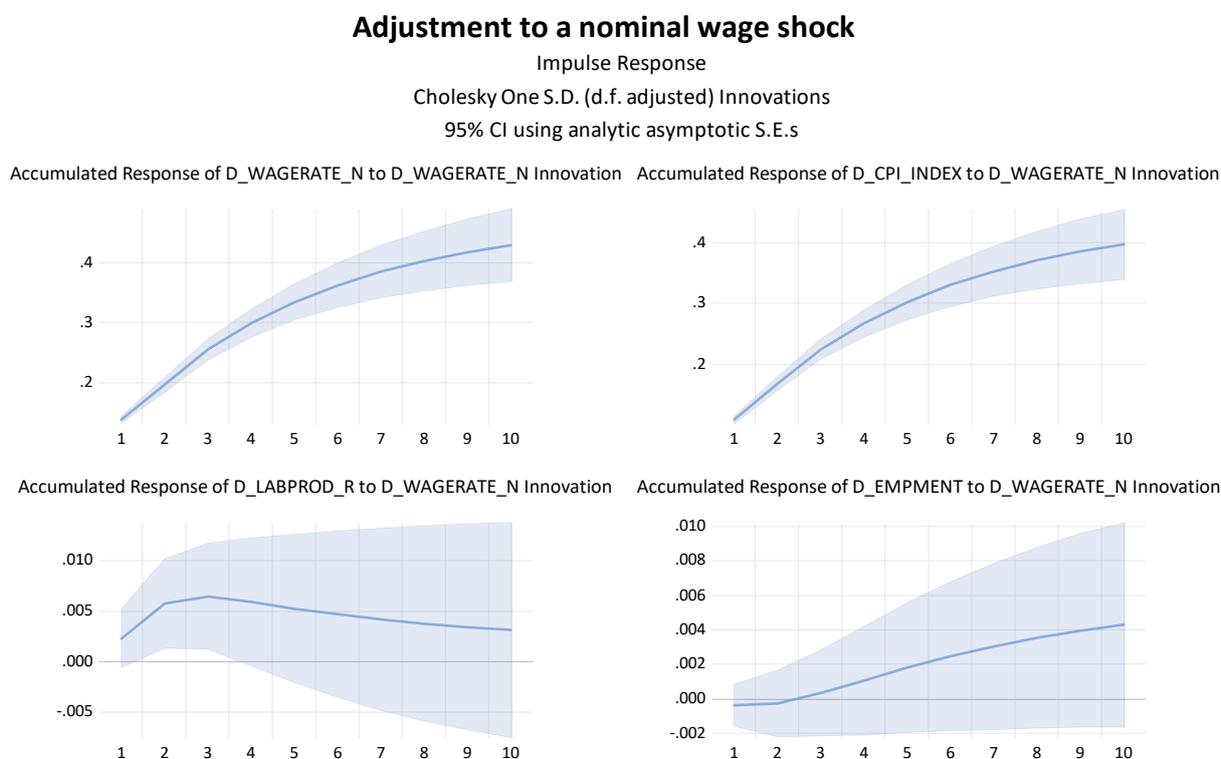
In a monetary economy, all economic decisions are expressed in nominal units. As a result, adjustment is typically initiated by nominal income-claim shocks, with real variables adjusting only insofar as nominal accommodation is constrained. When macroeconomic policy-monetary and fiscal policy jointly-provides a credible nominal anchor, wage and price setting are disciplined. If the anchor holds, a markup shock reduces the wage share, while a wage shock compresses the profit share. Because nominal adjustment is limited, these distributional pressures must be resolved through real adjustment. Such adjustment may be productive, raising labour productivity, or destructive, occurring through lower employment, falling real wages, and a declining wage share (see equation (12)).

To quantify how economies absorb nominal income-claim shocks, I estimate a panel VAR with four endogenous variables,  $y_{i,t} = (\Delta w_{i,t}, \Delta p_{i,t}, \Delta \ln \lambda_{i,t}, \Delta \ln L_{i,t})'$ , where  $\Delta w_{i,t}$  denotes nominal wage growth,  $\Delta p_{i,t}$  CPI inflation,  $\Delta \ln \lambda_{i,t}$  labour-productivity growth, and  $\Delta \ln L_{i,t}$  employment growth. The VAR is estimated in first differences with two lags and a constant. The elasticity of substitution  $\sigma_{i,t}$  enters as an exogenous control, capturing slow-moving changes in the production structure over the annual horizon of wage-price dynamics:

$$y_{i,t} = c + \sum_{j=1}^2 A_j y_{i,t-j} + \Gamma \sigma_{i,t} + u_{i,t}, \quad E[u_{i,t}] = 0, \quad E[u_{i,t} u_{i,t'}] = \Sigma_u.$$

Structural shocks are identified using a recursive (Cholesky) decomposition with baseline ordering  $(\Delta w, \Delta p, \Delta \ln \lambda, \Delta \ln L)$ . This ordering reflects a nominal-claims-first adjustment mechanism: wage bargaining initiates nominal pressure, prices adjust contemporaneously, and real variables respond with a lag, with employment acting as the residual margin of adjustment. Robustness is assessed by reversing the ordering of wages and prices, corresponding to markup-led nominal adjustment. The resulting impulse responses are qualitatively unchanged (see Appendix D).

Figure 8 reports cumulative impulse responses from the baseline panel VAR(2), estimated on the pooled sample with ordering  $\Delta w \rightarrow \Delta p \rightarrow \Delta \lambda \rightarrow \Delta L$ . Shaded areas denote 90% confidence intervals over a ten-year horizon. VAR coefficient tables appear in the Appendix D; I focus here on the adjustment dynamics captured by impulse responses and the derived ASI and PSI indices.

Figure 8.<sup>14</sup>

## 5.2. The adjustment share indices

I construct the Adjustment Share Index (ASI) from impulse response functions to measure the share of adjustment occurring through productivity growth rather than wage-price inflation. For each shock  $\varepsilon$ , cumulative responses are defined up to horizon  $h$ :

$$(27) \quad W_s(H) = \sum_{h=0}^H \text{IRF}^{w \leftarrow s}(h)$$

$$(28) \quad P_s(H) = \sum_{h=0}^H \text{IRF}^{p \leftarrow s}(h)$$

$$(29) \quad \Lambda_s(H) = \sum_{h=0}^H \text{IRF}^{\lambda \leftarrow s}(h)$$

$$(30) \quad L_s(H) = \sum_{h=0}^H \text{IRF}^{L \leftarrow s}(h)$$

To prevent shares exceeding unity or turning negative when signs differ, I use absolute cumulative contributions. ASI is a variance-share-style metric based on absolute cumulative impulse responses, not a structural share in an accounting identity. The ASI is then:

<sup>14</sup> File: masterpage g\_var\_wage\_empl\_ok

$$(31) \quad ASI(H) = \frac{|\Lambda_s(H)|}{|\Lambda_s(H)| + |P_s(H)| + |W_s(H)|}$$

If ASI is high, then the system adjusts more through productivity growth than through wage-price inflation. Note that we are comparing productivity to wage and price joint nominal adjustment.

The Productivity Share Index (PSI) indicates how much is achieved *within* the real adjustment by increasing productivity and how much by reducing employment:

$$(32) \quad PSI(H) = \frac{|\Lambda_s(H)|}{|\Lambda_s(H)| + |L_s(H)|}$$

Table 6 reveals stark differences across development groups. The productivity share of adjustment (ASI) rises with development. However, strong nominal anchors constrain this mechanism: price stability forces real adjustment through productivity gains, but at the cost of slower employment growth.

**Table 6.**<sup>15</sup>

Adjustment share index					Productivity share index				
	ASI 14	ASI poor	ASI middle	ASI rich		PSI 14	PSI poor	PSI middle	PSI rich
Mean	0.432452	0.359502	0.425474	0.484595	Mean	0.655136	0.77606	0.643198	0.596909
Median	0.416636	0.253483	0.416636	0.485301	Median	0.710598	0.827604	0.707936	0.645715
Maximum	0.997377	0.978245	0.9871	0.997377	Maximum	0.99989	0.99989	0.994362	0.985416
Minimum	0.00033	0.005613	0.00033	0.000358	Minimum	0.000399	0.084863	0.001471	0.000399
Std. Dev.	0.279297	0.276594	0.291828	0.256014	Std. Dev.	0.258318	0.214095	0.267337	0.249282
Skewness	0.267053	0.702365	0.224422	0.169669	Skewness	-0.75532	-1.56254	-0.74193	-0.47872
Kurtosis	1.979924	2.278184	1.876317	2.182765	Kurtosis	2.598774	4.886912	2.513072	2.374318
Jarque-Ber.	19.33493	7.794639	9.150776	4.078246	Jarque-Ber.	35.62726	41.64542	15.24325	6.813423
Probability	6.33E-05	0.020296	0.010302	0.130143	Probability	1.84E-08	9.05E-10	0.00049	0.03315
Sum	151.3582	26.96266	63.82111	60.5744	Sum	229.2978	58.20447	96.47964	74.61366
Sum Sq.	92.67946	15.35446	39.84359	37.48141	Sum Sq.	173.5096	48.56207	72.70437	52.24311
Sum Sq. De	27.22433	5.661332	12.68936	8.127344	Sum Sq. De	23.28821	3.391925	10.6489	7.705526
Observatio	350	75	150	125	Observatio	350	75	150	125

Regardless of whether nominal pressure originates in wage bargaining or price setting, adjustment occurs primarily through productivity. This motivates the ROC regressions below: economies that translate nominal pressure into productivity growth—conditional on  $\sigma$ —sustain higher returns on capital without inflation or employment losses.

According to equation (20), the net return on capital depends on both the production structure, summarised by the elasticity of substitution  $\sigma$ , and how nominal income

<sup>15</sup> File: Inflation. ASI, Prodshare.xlsx Table ASI and PSI

claims are resolved relative to real productive capacity. ASI measures whether nominal pressure is absorbed through productivity growth - raising  $\kappa = \frac{Y}{K}$  for given factor shares - or through wage-price adjustment that leaves capital productivity unchanged. PSI identifies whether real adjustment operates via efficiency gains or employment compression.

In the ROC regressions below, the interactions of ASI, PSI, and  $\sigma$  capture the economy's effective flexibility ( $\sigma^{\text{eff}} = \sigma \times \text{ASI}$ ). Even with given technological elasticity  $\sigma$ , sustaining capital returns requires that nominal claims translate into productivity growth rather than inflation or labour shedding (PSI). Without this translation into productivity, the economy cannot reach its production possibility frontier.

Growth affects profitability, while profitability in turn drives investment. Investment alters factor intensities, and institutional arrangements respond endogenously to economic outcomes. These feedback loops imply pervasive endogeneity between growth, profitability, production structure, and adjustment regimes.

To identify the causal channels, I proceed in three steps. First, I estimate the effect of the elasticity of substitution  $\sigma$  on the return on capital (ROC), isolating the flexibility channel from slow-moving structural change. Second, I establish that profitability drives income growth by estimating the effect of ROC on GDP per capita growth, capturing the competitiveness channel. Third, I combine both stages to assess how production structure and adjustment regimes jointly shape long-run development outcomes.

### 5.3. The flexibility channel

Building on the adjustment regime measures developed in Section 5.2, this section examines whether technological flexibility translates into higher capital returns. According to equation (20), the net return on capital depends on both the production structure, summarised by the elasticity of substitution  $\sigma$ , and on how nominal income claims are resolved relative to real productive capacity. The Adjustment Share Index (ASI) and the Productivity Share Index (PSI) summarise these resolution mechanisms and are therefore introduced into the ROC regressions to capture the economy's effective flexibility.

I estimate dynamic panel regressions of the return on capital (ROC) on technological flexibility, adjustment regimes, and their interaction terms, allowing for development-group heterogeneity. The interaction between  $\sigma$  and ASI captures effective flexibility, defined as the extent to which technological substitution operates through real productivity adjustment rather than nominal accommodation. The theoretical framework predicts that  $\sigma$  is necessary but insufficient for higher capital returns: technological flexibility raises ROC only when nominal adjustment is constrained, and income-claim pressures are translated into productivity gains rather than inflation or labour shedding.

The baseline ROC regression equation (33), which includes  $\sigma$ , ASI, PSI, and their interaction, is applied to the full 14-country panel and, as reported in Appendix E, separately to poor, middle-income, and rich economies (where  $i$  stands for the three subgroups):

$$ROC_{i,t} = \alpha ROC_{i,t-1} + \beta_1 \sigma_{i,t} + \beta_2 ASI_{i,t} + \beta_3 (\sigma_{i,t} \times ASI_{i,t}) + \beta_4 PSI_{i,t} + \gamma' X_{i,t} + \mu_i + \tau_t + \varepsilon_{i,t}$$

$\sigma$  denotes the elasticity of substitution; ASI captures the share of real adjustment through productivity; PSI captures the split of real adjustment between productivity and employment. Exchange rates and inflation are included as controls for competitiveness. Because profitability, factor shares, and productivity are jointly determined, simple fixed-effects regressions are subject to simultaneity bias. I therefore estimate dynamic specifications that include lagged ROC and address endogeneity using internal instruments in an Arellano–Bond–Blundell system-GMM framework (Arellano and Bond, 1991). Potentially endogenous regressors—including  $\sigma$ , ASI, PSI, and their interaction terms—are instrumented with suitable lagged levels and differences. Country fixed effects are removed by differencing, time effects control for common shocks, and instrument proliferation is limited by restricting lag depth and collapsing the instrument matrix. Inference relies on Windmeijer-corrected robust standard errors, with specification validity assessed using serial-correlation and Hansen tests.

The results for the full panel are reported in Table 7. Capital returns are highly persistent, as indicated by the positive and statistically significant coefficient on lagged ROC. Across all specifications, the direct effect of technological flexibility ( $\sigma$ ) on the return on capital is economically small and statistically insignificant. Adjustment-regime variables—including ASI, PSI, and their interaction with  $\sigma$ —likewise do not enter significantly once nominal channels are explicitly controlled for. This pattern is fully consistent with the theoretical framework: neither technological flexibility nor real adjustment regimes raise capital returns in isolation when distributional pressures can be accommodated through nominal price or wage adjustment.

The absence of statistically significant coefficients is therefore economically meaningful. The model predicts that  $\sigma$  affects ROC only when nominal accommodation is constrained, and distributional pressures are resolved through real productivity adjustment. While adjustment regimes play a central role in shaping competitiveness and growth dynamics elsewhere in the analysis, Table 7 shows that they do not exert an independent effect on capital returns in a pooled heterogeneous panel where nominal adjustment remains available. Heterogeneity in these mechanisms is explored explicitly in Figure 9.

Table 7.<sup>16</sup>

<b>Nominal Channels and Capital Returns</b>			
	<b>(1) Baseline: Technological Flexibility</b>	<b>(2) Nominal adjustment controlled</b>	<b>(3) Interaction with Adjustment Regimes</b>
	ROC	ROC	ROC
Lagged ROC	0.492* (0.272)	0.478* (0.237)	0.674** (0.276)
Elasticity of substitution ( $\sigma$ )	0.011 (0.273)	-0.013 (0.274)	0.044 (0.239)
Adjustment Share Index (ASI)	0.015 (0.609)	-0.023 (0.603)	0.095 (0.556)
$\sigma \times$ ASI	-0.033 (0.611)	0.014 (0.600)	-0.102 (0.552)
Productivity Share (PSI)	0.038 (0.048)	0.034 (0.045)	0.018 (0.042)
Time trend	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.000)
Exchange rate (log)		0.002 (0.002)	
Inflation ( $\Delta$ CPI)			0.087 (0.088)
Constant	1.675 (1.282)	1.933 (1.356)	1.128 (0.861)
Observations	336	336	336
Number of instruments	27	30	30
AR(2) p-value	0.233	0.233	0.211
Hansen p-value	1.000	1.000	1.000
Sargan p-value	0.000	0.000	0.000
Standard errors in parentheses			
* p < 0.10, ** p < 0.05, *** p < 0.01			

Figure 9 (based on estimation results reported in Appendix E) provides a complementary and more granular test of the flexibility channel by estimating the ROC equation separately for poor, middle-income, and rich economies. It reveals a systematic and economically meaningful pattern of heterogeneity across development stages. While the interaction between technological flexibility and the adjustment regime ( $\sigma \times$  ASI) is economically large

<sup>16</sup> File: Table\_6\_Robustness\_Nominal\_Channels

and negative in poor economies and negligible in rich economies, the middle-income group displays knife-edge dynamics.

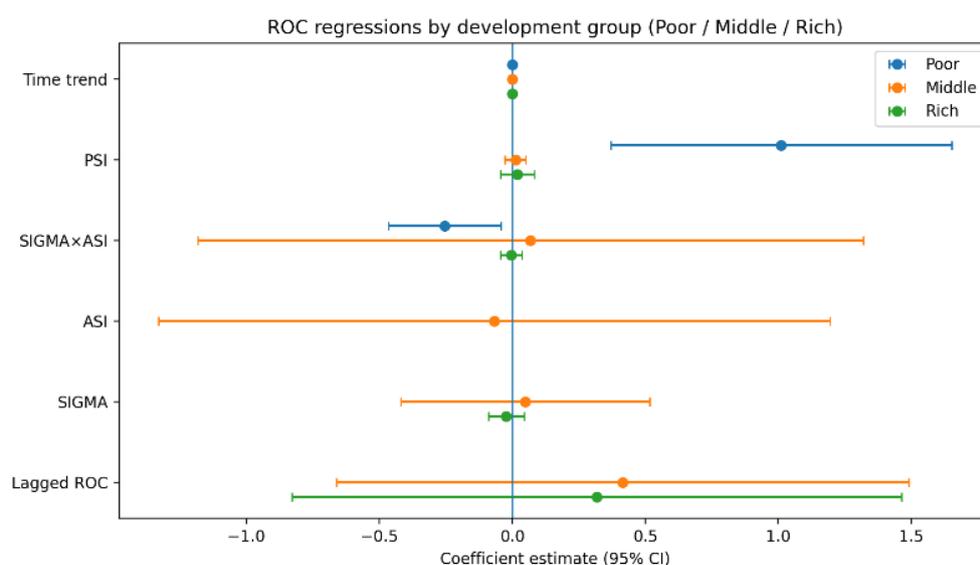
In poor economies, the interaction term ( $\sigma \times ASI$ ) is negative and economically large, indicating that higher technological flexibility combined with nominal stability tends to depress capital returns. This pattern is consistent with the model’s prediction that profits fall when capital substitutes for labour before sufficient complementary accumulation has taken place.

In middle-income economies, the interaction term is small and statistically insignificant, with wide confidence intervals. This reflects a transitional regime in which neither technological flexibility nor institutional discipline is yet dominant, and outcomes are highly sensitive to adjustment regimes. These knife-edge dynamics are consistent with the notion of a middle-income trap, where small changes in institutional or nominal conditions can reverse the effect of flexibility on capital returns.

In rich economies, the interaction term is economically negligible, consistent with mature adjustment regimes in which nominal stability and institutionalised coordination limit misallocation and stabilise capital returns.

Taken together, Figure 9 shows that the absence of average effects in Table 7 masks substantial structural heterogeneity. The middle-income trap emerges not as a smooth stage along a development continuum, but as a knife-edge regime in which the impact of technological flexibility critically depends on adjustment institutions.

**Figure 9.**



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*Notes: The dependent variable is the net return on capital (ROC). Estimates are two-step system-GMM with collapsed instruments. Lagged ROC is instrumented using second and third lags.  $\sigma$  denotes the elasticity of substitution; ASI is the Adjustment Share Index; PSI is the productivity share. Error bars represent 95 percent confidence intervals. Standard errors are robust. Country groups are defined ex ante as poor, middle-income, and rich economies.*

Section 5.3 showed that technological flexibility raises capital returns only when nominal income claims are resolved through real adjustment rather than price accommodation. Section 5.4 examines the final step in this sequence by asking whether higher capital returns translate into economic growth through competitiveness and investment dynamics.

#### 5.4. The Competitiveness Channel

While Section 5.3 established that technological flexibility raises the return on capital only when nominal income claims are resolved through real adjustment, this section examines whether higher capital returns translate into economic growth through the competitiveness channel.

To capture the dynamic adjustment of investment and output, I estimate fixed-effects growth regressions with lagged returns on capital, controlling for trade openness and real exchange-rate movements.<sup>17</sup> Country and year fixed effects absorb time-invariant structural characteristics and global shocks. Focus is on the post-Asian Financial Crisis period.

The results reveal a clear dynamic pattern. Higher capital returns are associated with a statistically significant increase in growth in the subsequent year, while the second lag enters with a similar magnitude but opposite sign. This offsetting pattern indicates that capital returns generate temporary growth accelerations rather than permanent increases in growth rates, consistent with investment-driven adjustment under competitive conditions.

External competitiveness plays a central role in this transmission. Real depreciations are robustly associated with faster growth, confirming that the translation of investment incentives into growth depends on external validation through the tradable sector. By contrast, trade openness does not exert an independent effect on growth once country and time effects are controlled for.

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<sup>17</sup> The growth regressions are estimated using fixed effects rather than dynamic panel GMM. While the specification includes lagged returns on capital, the time dimension of the panel is sufficiently long to mitigate concerns about Nickell bias, and the focus is on short-run conditional dynamics rather than structural parameter estimation (Nickell, 1981). System GMM would require strong assumptions about instrument validity and persistence that are difficult to justify in growth regressions with external competitiveness controls and common global shocks. Fixed effects therefore provide a transparent and conservative identification strategy, allowing the data to reveal whether capital returns predict subsequent growth without relying on potentially fragile moment conditions.

The results in Table 8 confirm this prediction. Higher returns on capital are associated with significantly faster income growth, conditional on openness and exchange-rate conditions. In contrast, measures of technological flexibility and adjustment regimes exert no direct effect on growth once returns are accounted for. Competitiveness therefore operates through the sustained profitability of capital rather than through flexibility per se.

**Table 8.**

**Dependent variable: GDP per capita growth**

Variable	Coefficient		Std. Error	t-statistic	p-value
ROC (t-1)	0.24293	***	0.06016	4.04	0.001
ROC (t-2)	-0.27373	***	0.06858	-3.99	0.002
Log openness	-0.00198		0.01149	-0.17	0.866
Real exchange rate shock	0.08882	***	0.02646	3.36	0.005
Constant	0.04063	***	0.01326	3.06	0.009

*Notes: The dependent variable is real GDP per capita growth. ROC(t-1) and ROC(t-2) denote the first and second lags of the net return on capital. Trade openness is measured as the logarithm of total trade relative to GDP. The real exchange rate shock is defined such that a positive value denotes a real depreciation. All specifications include country and year fixed effects. Standard errors are heteroskedasticity-robust and clustered at the country level. The sample covers 14 economies over the post-Asian Financial Crisis (1998) period. \*, \*\*, and \*\*\* denote statistical significance at the 10, 5, and 1 percent levels, respectively.*

The robustness test in Appendix G shows that this dynamic pattern of the competitiveness channel remains unchanged if we replace the observed capital returns with their predicted component from equation (33).

The dynamic pattern uncovered in Table 8 speaks directly to the middle-income trap literature. Higher capital returns generate temporary growth accelerations rather than permanent increases in growth rates, consistent with investment-driven transitions rather than sustained endogenous growth. In this framework, middle-income economies grow rapidly when rising capital returns trigger competitiveness-enhancing investment, but growth decelerates once the adjustment is completed unless new sources of productivity growth emerge. The results therefore reconcile episodes of rapid catch-up growth with subsequent slowdowns, highlighting that the middle-income trap reflects a failure to sustain capital returns through structural and competitiveness-enhancing transformation rather than an absence of investment incentives per se.

The heterogeneity results reported in Appendix G reveal a knife-edge structure in the growth-capital-returns relationship. In poor economies, growth responds only weakly and unstably

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to changes in capital returns, reflecting abundant labour and limited effective substitution. In middle-income economies, the capital-return channel largely collapses: lagged returns on capital no longer discipline growth, and adjustment shifts toward the real exchange rate instead. Only in rich economies does growth exhibit a well-identified dynamic response to capital returns, with positive short-run effects and stabilising medium-run correction. This pattern implies that growth is governed by capital returns only once sufficient structural and institutional conditions are met; below this threshold, the economy operates on a knife-edge in which small shocks redirect adjustment away from real productivity and toward nominal or external channels.

Taken together, Sections 5.3 and 5.4 establish a sequential mechanism: technological flexibility is a necessary but insufficient condition for growth; adjustment regimes determine whether flexibility raises capital returns; and competitiveness determines whether higher returns translate into sustained income growth.

### 5.5. Robustness Across Development Stages

As a robustness check, we allow for a direct effect of technological flexibility in the growth equation by augmenting the baseline specification with flexibility alongside the estimated return on capital. Consistent with the proposed transmission mechanism, flexibility does not exert an economically meaningful long-run effect on growth once capital returns are controlled for and dynamics are accounted for. This supports the interpretation that flexibility affects growth indirectly through competitiveness and capital returns rather than through a direct growth channel (Table H1, Appendix H).

## Conclusion

This paper develops a structural account of why middle-income convergence often stalls in Southeast Asia. The focus is on competitiveness, defined as the net return on capital (ROC), which governs investment incentives and therefore the evolution of output per capita. Competitiveness depends on capital accumulation, technological flexibility, and macroeconomic regimes. I show that technological flexibility—captured by a time-varying elasticity of substitution between capital and labour—does not raise growth mechanically. Its developmental impact depends on whether distributional pressures are resolved through real adjustment rather than nominal accommodation.

Using a panel VAR for wage growth, inflation, productivity growth, and employment growth, I construct two adjustment-regime measures. The Adjustment Share Index (ASI) captures the extent to which nominal shocks are absorbed through productivity rather than wage-price inflation, and the Productivity Share Index (PSI) distinguishes productivity-based adjustment from employment compression. These indices reveal systematic regime differences across development stages: as economies become more

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capital-intensive, a larger share of adjustment occurs through productivity, but the composition of real adjustment shifts away from employment growth.

The econometric results support a sequential transmission mechanism. In the flexibility channel, ROC responds to the interaction between the production structure and the adjustment regime: effective flexibility matters only insofar as technological substitution is activated by real adjustment. In the competitiveness channel, higher ROC predicts subsequent income growth, but the dynamic pattern is offsetting, implying temporary growth accelerations rather than permanent increases in growth rates. Real exchange rate movements play an independent role, indicating that investment-driven growth requires external validation through the tradable sector.

Taken together, the findings reinterpret the middle-income trap as a knife-edge regime. When nominal accommodation substitutes for real reallocation, technological flexibility remains latent and does not translate into sustained profitability; when real adjustment is institutionally enforced, flexibility can stabilise capital returns and sustain convergence. The policy implication is that successful upgrading requires synchronising production-side flexibility with nominal discipline: without institutions that channel income-claim pressure into productivity-enhancing transformation, higher substitutability alone is not a development strategy.

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## Appendices

### Appendix A. Data and Variable Definitions

variables	variables name	calculation	unit	source
GDP	Gross domestic product in local currency at current price		million local currency unit	APO
GDP_usd	Gross domestic product in usd at current price	GDP/fx usd	million usd	APO
GDP_yuan	Gross domestic product in currency at current price	GDP/fx yuan	million yuan	APO
GDPPC	GDP per capita in local currency	(GDP/population) * 1000	lcu per person	APO
GDPPC_usd	GDP per capita in usd	(GDP/(fx usd * population)) * 1000	usd per person	APO
GDPPC_yuan	GDP per capita in yuan	(GDP/(fx yuan * population)) * 1000	yuan per person	APO
tax	Taxes on income, profits, and capital gains		% of GDP	IMF-GFS,
taxind	Indirect taxes on production and imports		million local currency unit	APO
comp	compensaton of employee		million local currency unit	APO
operate	operating surplus and mixed income		million local currency unit	APO
k	capital stock		million local currency unit	APO
ACE	average capital efficiency	nominal GDP/ nominal capital stock		APO
ACEcomp	relative ACE to china			
labprod	labor productivity	GDP/ employment		APO
wage	wage	(labor productivity * labor share) * 1	lcu per employed person	
WCI	wage competitiveness index	local wage in usd/ chinese wage in usd		
sharepro	profit share		[0, 1]	APO
sharelab	labor share		[0, 1]	APO
ROC	return on capital	ACE * profit share		APO
ROCcomp	relative ROC to china	ROC local/ROC china		
pop	populatiion		1000 people	APO
empment	employment		1000 people	APO
empyee	employee		1000 people	APO
empyee/empme	employee per employment	employee/employment	[0, 1]	APO
empmentrate	employment rate	employment/population	[0, 1]	APO
fx_usd	exchange rate: local currency to USD			APO
fx_yuan	exchange rate: local currency to Yuan			APO
k/l	capital-labor ratio	real capital/ employment		APO
		cobb-douglas production function with variable shares		
TFP	total factor productivity			
PR	political rights		index [1,7]	Freedom ho
CL	civil liberties		index [1,7]	Freedom ho
CPI	consumer price index			APO
laborquality	labor quality index			APO
ICT	ICT capital index			APO
nonICT	non ICT capital index			APO
ex	export of goods and services		million lcu	APO
im	import of goods and services		million lcu	APO
ex_%GDP	export of goods and services as percentage of GDP	export/ nominal GDP	% of GDP	
im_%GDP	import of goods and services as percentage of GDP	import/ nominal GDP	% of GDP	
openess	trade openness	(ex_%GDP + im_%GDP)/2		
HDI	Human development index			World Bank
edutert	tertiary education as percentage of population		% of population	World Bank
edusec	secondary education as percentage of population		% of population	World Bank
m2	broad money		million lcu	
corrupt	Control of Corruption: Estimate			WGI
govef	Government Effectiveness: Estimate			WGI
regulate	Regulatory Quality: Estimate			WGI
rulelaw	Rule of Law: Estimate			WGI
voice	Voice and Accountability: Estimate			WGI
i	interest rate			BIS
WUI	world uncertainty index			

## Appendix B. Theoretical derivations

Starting point (factor-augmenting CES):

$$Y = A[a(E_L L)^\rho + (1 - a)(E_K K)^\rho]^{1/\rho}, \quad \rho = \frac{\sigma - 1}{\sigma} \in (0, 1) \text{ for } \sigma > 1.$$

Define the effective capital–labour ratio and the CES aggregator:

$$x := \frac{E_K K}{E_L L}, \quad F(x) := a + (1 - a)x^\rho.$$

Step 1: Factor out  $(E_L L)^\rho$  inside the brackets.

Inside (1),

$$a(E_L L)^\rho + (1 - a)(E_K K)^\rho = (E_L L)^\rho \left[ a + (1 - a) \left( \frac{E_K K}{E_L L} \right)^\rho \right] = (E_L L)^\rho F(x).$$

Hence,

$$Y = A[(E_L L)^\rho F(x)]^{1/\rho} = A(E_L L)[F(x)]^{1/\rho}.$$

Since  $\rho = \frac{\sigma - 1}{\sigma}$ , we have  $\frac{1}{\rho} = \frac{\sigma}{\sigma - 1}$ . Writing  $H := E_L L$ , (4) can be expressed compactly as:

$$Y = AH[F(x)]^{\sigma/(\sigma - 1)} = AH[F(x)]^{1/\rho}.$$

Step 2: Productivities

From (4) and  $x = \frac{E_K K}{E_L L}$ , we obtain:

$$\frac{Y}{L} = AE_L [F(x)]^{1/\rho} \quad \text{and} \quad \frac{Y}{K} = AE_K \frac{1}{x} [F(x)]^{1/\rho}.$$

Step 3: Factor Shares

Under perfect competition with constant returns to scale,

$$s_w = \frac{wL}{Y} = \frac{\partial Y / \partial L \cdot L}{Y}, \quad s_\pi = \frac{rK}{Y} = \frac{\partial Y / \partial K \cdot K}{Y}.$$

Differentiate (1):

$$\frac{\partial Y}{\partial L} = A \cdot \frac{1}{\rho} [\dots]^{1/\rho-1} \cdot a\rho(E_L L)^{\rho-1} E_L = AaE_L(E_L L)^{\rho-1} [\dots]^{1/\rho-1}.$$

Therefore,

$$s_w = \frac{AaE_L(E_L L)^{\rho-1} [\dots]^{1/\rho-1} L}{A[\dots]^{1/\rho}} = \frac{a(E_L L)^\rho}{a(E_L L)^\rho + (1-a)(E_K K)^\rho} = \frac{a}{F(x)}.$$

Similarly,

$$s_\pi = \frac{(1-a)(E_K K)^\rho}{a(E_L L)^\rho + (1-a)(E_K K)^\rho} = \frac{(1-a)x^\rho}{F(x)} = 1 - s_w.$$

Step 4: Rate of Return on Capital, "ROC"

$$\text{Define ROC} := \frac{Y}{K} (1 - s_w) = \frac{Y}{K} s_\pi.$$

Using (6) and (8),

$$\text{ROC} = \left( AE_K \frac{1}{x} [F(x)]^{1/\rho} \right) \cdot \frac{(1-a)x^\rho}{F(x)}$$

or, equivalently (as you wrote),

$$\ln \text{ROC} = \ln A + \ln E_K - \ln x + \frac{1}{\rho} \ln F(x) + \ln(1 - s_w).$$

Step 5: Elasticity of ROC w.r.t.  $x$  at fixed  $\sigma$

Hold  $\sigma$  (hence  $\rho$ ) constant. A convenient form of (9) is:

$$\ln \text{ROC} = \ln A + \ln E_K + (\rho - 1) \ln x + \left( \frac{1}{\rho} - 1 \right) \ln F(x) + \ln(1 - a),$$

since  $\ln(1 - s_w) = \ln((1 - a)x^\rho) - \ln F(x)$ .

Differentiate w.r.t.  $\ln x$ :

$$\frac{\partial \ln \text{ROC}}{\partial \ln x} \Big|_\sigma = (\rho - 1) + \left( \frac{1}{\rho} - 1 \right) \frac{\partial \ln F}{\partial \ln x}.$$

Because  $F(x) = a + (1 - a)x^\rho$ ,

$$\frac{\partial \ln F}{\partial \ln x} = \frac{(1 - a)\rho x^\rho}{F(x)} = \rho s_\pi = \rho(1 - s_w).$$

Hence,

$$\frac{\partial \ln \text{ROC}}{\partial \ln x} \Big|_{\sigma} = (\rho - 1) + \left(\frac{1}{\rho} - 1\right) \rho (1 - s_w) = (\rho - 1) s_w = -\frac{s_w}{\sigma} < 0,$$

since  $\rho - 1 = -1/\sigma$ .

This is

$$\Omega = \frac{\partial \ln \text{ROC}}{\partial \ln x} \Big|_{\sigma} = -\frac{s_w}{\sigma}.$$

Step 6: Allowing  $\sigma$  to vary: log-difference and semi-elasticity

Take first differences of (9) and apply a first-order expansion when  $\sigma$  varies:

$$\Delta \ln \text{ROC} \approx \Delta \ln A + \Delta \ln E_K + \Omega \Delta \ln x + \Psi(x, \sigma) \Delta \sigma,$$

with  $\Omega$  from (10) and

$$\Psi(x, \sigma) = \frac{\partial \ln \text{ROC}}{\partial \sigma} \Big|_x = \frac{2 \ln x}{\sigma^2} + \frac{(1 - s_w) \ln x}{(\sigma - 1) \sigma^2} - \frac{\ln F(x)}{(\sigma - 1)^2}.$$

Sketch of (11): Write  $\ln \text{ROC} = \ln A + \ln E_K + (\rho - 1) \ln x + \left(\frac{1}{\rho} - 1\right) \ln F(x; \rho) + \ln(1 - a)$

with  $\rho = \frac{\sigma - 1}{\sigma}$ . Use  $\frac{d\rho}{d\sigma} = \frac{1}{\sigma^2}$ ,  $\frac{d(1/\rho)}{d\sigma} = -\frac{1/\sigma^2}{\rho^2}$ , and  $\partial_{\rho} \ln F = \frac{(1-a)x^{\rho} \ln x}{F} = s_{\pi} \ln x = (1 - s_w) \ln x$ .

Collecting terms yields (11).

### Summary of Key Identities

$$Y = A(E_L L)[F(x)]^{1/\rho}, \text{ with } x = \frac{E_K K}{E_L L} \text{ and } F(x) = a + (1 - a)x^{\rho}, \rho = \frac{\sigma - 1}{\sigma}.$$

$$\frac{Y}{L} = A E_L [F(x)]^{1/\rho}, \frac{Y}{K} = A E_K x^{-1} [F(x)]^{1/\rho}.$$

$$s_w = \frac{a}{F(x)}, s_{\pi} = \frac{(1-a)x^{\rho}}{F(x)} = 1 - s_w.$$

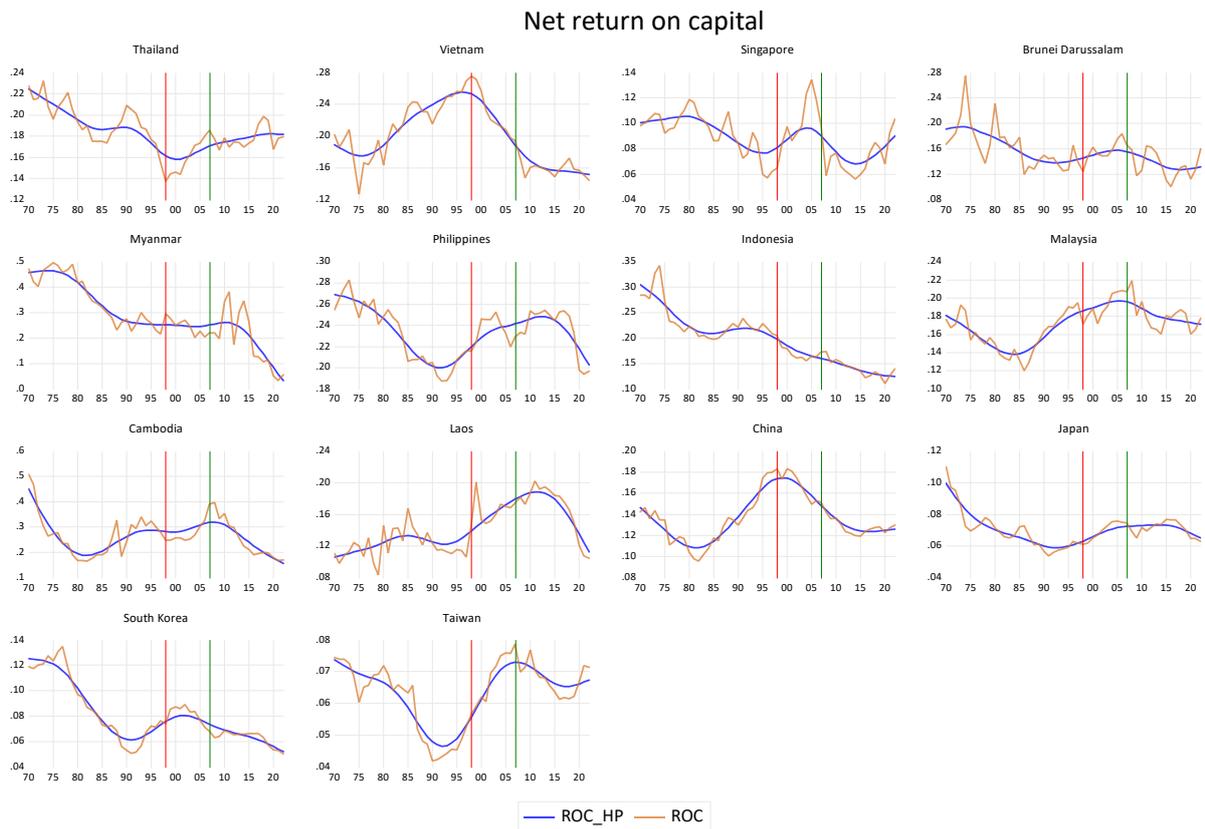
$$\ln \text{ROC} = \ln A + \ln E_K - \ln x + \frac{1}{\rho} \ln F(x) + \ln(1 - s_w).$$

$$\text{Elasticity at fixed } \sigma: \Omega = \frac{\partial \ln \text{ROC}}{\partial \ln x} \Big|_{\sigma} = -\frac{s_w}{\sigma}.$$

$$\text{Semi-elasticity to } \sigma: \Psi(x, \sigma) = \frac{2 \ln x}{\sigma^2} + \frac{(1 - s_w) \ln x}{(\sigma - 1) \sigma^2} - \frac{\ln F(x)}{(\sigma - 1)^2}.$$

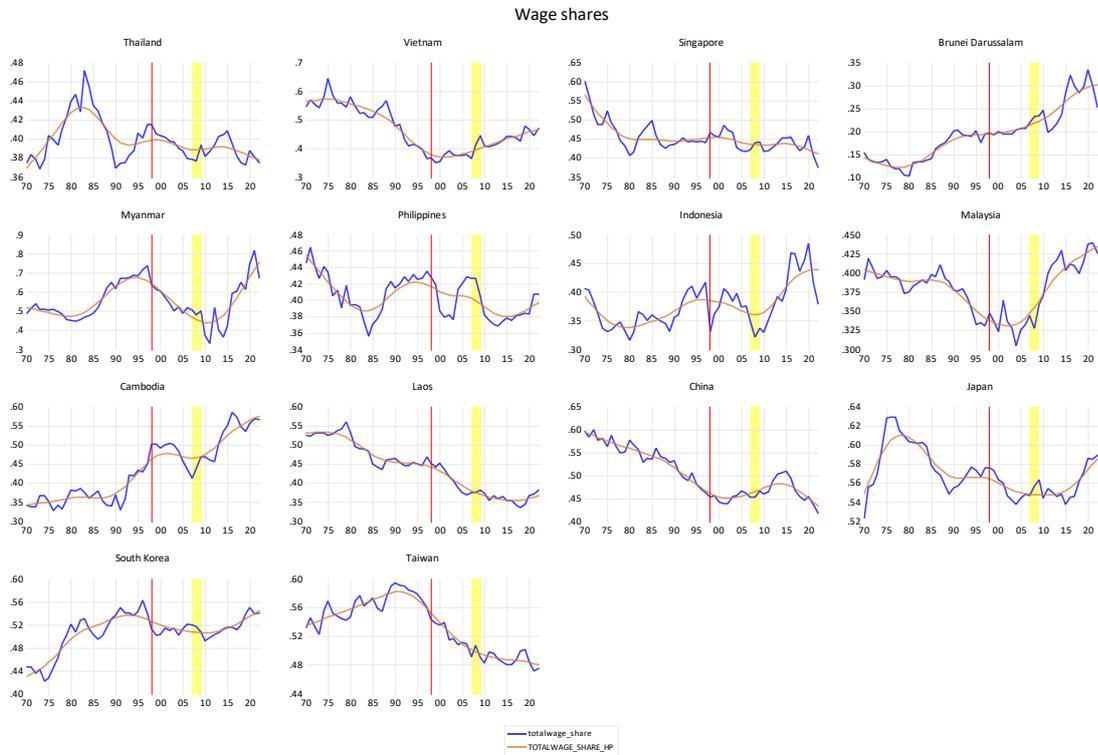
## Appendix C. Figures

Figure C1.<sup>18</sup> Return on Capital



<sup>18</sup> File\_GMM poor\_3

Figure C2. Wage shares



## Appendix D. VAR Estimates

Vector Autoregression Estimates

Date: 01/03/26 Time: 16:02

Sample (adjusted): 1973 2022

Included observations: 700 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	D_WAGER...	D_CPI_INDEX	D_LABPR...	D_EMPMENT
D_WAGERATE_N(-1)	0.4028653... 0.0774352... [ 5.20261]	0.3370815... 0.0712991... [ 4.72771]	0.0969278... 0.0264069... [ 3.67055]	0.0004203... 0.0109080... [ 0.03853]
D_WAGERATE_N(-2)	0.0414111... 0.0784018... [ 0.52819]	0.0435310... 0.0721891... [ 0.60301]	0.0640181... 0.0267365... [ 2.39441]	-0.0086819... 0.0110441... [-0.78611]
D_CPI_INDEX(-1)	0.0248524... 0.0841466... [ 0.29535]	0.1131817... 0.0774786... [ 1.46081]	-0.0940923... 0.0286956... [-3.27898]	0.0009717... 0.0118534... [ 0.08198]
D_CPI_INDEX(-2)	0.2507745... 0.0817976... [ 3.06579]	0.2281915... 0.0753158... [ 3.02980]	-0.0805789... 0.0278945... [-2.88870]	0.0155227... 0.0115225... [ 1.34716]
D_LABPROD_R(-1)	0.1929497... 0.1155591... [ 1.66971]	-0.0244579... 0.1064020... [-0.22986]	0.1702907... 0.0394078... [ 4.32123]	0.0246670... 0.0162784... [ 1.51532]
D_LABPROD_R(-2)	0.1140263... 0.1150629... [ 0.99099]	-0.0677121... 0.1059451... [-0.63912]	-0.0284286... 0.0392386... [-0.72451]	-0.0029470... 0.0162085... [-0.18182]
D_EMPMENT(-1)	0.7347700... 0.2759684... [ 2.66251]	0.4402831... 0.2541001... [ 1.73271]	0.1192309... 0.0941105... [ 1.26692]	0.3168685... 0.0388747... [ 8.15102]
D_EMPMENT(-2)	0.0251125... 0.2766203... [ 0.09078]	-0.0428727... 0.2547004... [-0.16833]	-0.0722999... 0.0943328... [-0.76643]	0.1538294... 0.0389665... [ 3.94773]
C	0.0146397... 0.0228476... [ 0.64076]	-0.0014076... 0.0210371... [-0.06691]	-0.0161902... 0.0077914... [-2.07794]	0.0129025... 0.0032184... [ 4.00890]
SIGMA	0.0010586... 0.0213224... [ 0.04965]	0.0084198... 0.0196327... [ 0.42887]	0.0343161... 0.0072713... [ 4.71937]	-0.0024814... 0.0030036... [-0.82616]
R-squared	0.4259534...	0.4557713...	0.1198343...	0.1683611...
Adj. R-squared	0.4184658...	0.4486726...	0.1083538...	0.1575137...
Sum sq. resids	13.109133...	11.113865...	1.5245149...	0.2601295...
S.E. equation	0.1378359...	0.1269135...	0.0470047...	0.0194164...
F-statistic	56.888121...	64.205485...	10.438144...	15.520787...
Log likelihood	398.96292...	456.75343...	1152.0344...	1770.9226...
Akaike AIC	-1.1113226...	-1.2764383...	-3.2629555...	-5.0312075...
Schwarz SC	-1.0463071...	-1.2114229...	-3.1979400...	-4.9661920...
Mean dependent	0.1169805...	0.0876834...	0.0271711...	0.0217929...
S.D. dependent	0.1807485...	0.1709240...	0.0497788...	0.0211538...
Determinant resid covariance (dof adj.)	5.981136863255915e-11			
Determinant resid covariance	5.646611953227085e-11			
Log likelihood	4286.055216204793			
Akaike information criterion	-12.13158633201369			
Schwarz criterion	-11.87152459858264			
Number of coefficients	40			

### Appendix E. Baseline ROC Estimates by Income group

Group	Variable	Coefficient	StdErr	LowerCI	UpperCI
Poor	Lagged ROC				
	SIGMA				
	ASI				
	SIGMA×ASI	-0.25367	0.10813	-0.46560	-0.04174
	PSI	1.01164	0.32650	0.37170	1.65158
	Time trend	-0.00024	0.00010	-0.00043	-0.00004
	Constant				
Middle	Lagged ROC	0.41568	0.54866	-0.65969	1.49106
	SIGMA	0.04914	0.23882	-0.41895	0.51724
	ASI	-0.06720	0.64411	-1.32965	1.19525
	SIGMA×ASI	0.06901	0.63768	-1.18084	1.31886
	PSI	0.01246	0.01982	-0.02638	0.05130
	Time trend	0.00002	0.00016	-0.00030	0.00034
	Constant				
Rich	Lagged ROC	0.31741	0.58453	-0.82826	1.46308
	SIGMA	-0.02202	0.03381	-0.08828	0.04425
	ASI				
	SIGMA×ASI	-0.00382	0.02093	-0.04485	0.03721
	PSI	0.01918	0.03199	-0.04351	0.08188
	Time trend	0.00004	0.00004	-0.00003	0.00010

### Appendix F. Robustness : Growth equation

As a robustness check, I replace observed capital returns with their predicted component obtained from the adjustment-regime regression in Section 5.3. The dynamic

pattern of the competitiveness channel remains unchanged: higher predicted capital returns are associated with temporary growth accelerations, followed by mean reversion, while real exchange rate shocks retain a robust positive effect. This confirms that the growth response is driven by the structural component of capital returns rather than by transitory or endogenous fluctuations.

**Table F 1**

G	Coefficient	std. err.	t	P> t
<i>ROC_hat</i>				
L1.	0.67373	0.47211	1.43	0.177
L2.	-0.84183	0.45664	-1.84	0.088
OPENESS_LN	-0.00191	0.00951	-0.2	0.844
RER_SHOCK	0.07033	0.02624	2.68	0.019

This regression confirms the main-text adjustment results in Table 6. The sign pattern remains with positive short run effects and offsetting medium run reversals, although the statistical precision of the coefficients is lower. This is expected because  $\widehat{ROC}_{it}$  is a generated regressor. The real effective exchange rate shock becomes more robust once the return on capital is restricted to its structural component. This means that external competitiveness shocks dominate the growth response. Growth is validated externally not mechanically through returns alone. Finally openness remains insignificant because it is a conditioning environment and not a marginal driver. Hence, growth responds to the component of capital returns generated by technological flexibility and real adjustment, not to transitory fluctuations.

## Appendix G. Heterogeneity and Transmission Diagnostics

This table G 1 reports regime-specific fixed-effects regressions of growth on lagged returns on capital. The estimates are intended as diagnostics of transmission mechanisms rather than as standalone causal estimates. The results reveal substantial regime-dependence: in poor economies, growth responds weakly and unstably to capital returns; in middle-income economies, the return-on-capital channel largely disappears and is partially replaced by real exchange rate adjustment; and in rich economies, growth exhibits well-identified dynamic responses to capital returns. These patterns are consistent with knife-edge dynamics in which growth is disciplined by capital returns only beyond a threshold level of structural and institutional development.

**Table G.1**

<b>Poor countries</b>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Dependent Variable: G				
ROC(-1)	0.304415	0.217857	1.397315	0.170022
ROC(-2)	-0.44044	0.251939	-1.74819	0.088103 *
OPENESS_LN	-0.00541	0.071916	-0.07523	0.94041
RER	0.228584	0.139561	1.637878	0.109291
C	0.068434	0.054769	1.249503	0.218743
Effects Specification				
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				

<b>Middle-income countries</b>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Dependent Variable: G				
ROC(-1)	-0.27399	0.246667	-1.11076	0.269187
ROC(-2)	0.199143	0.220877	0.9016	0.369313
OPENESS_I	-0.00565	0.011166	-0.50589	0.613984
RER	0.10313	0.045283	2.277443	0.024767 **
C	0.053615	0.017931	2.990069	0.003468 ***
Effects Specification				
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				
<b>Rich countries</b>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Dependent Variable: G				
ROC(-1)	0.749426	0.299449	2.502686	0.014263 **
ROC(-2)	-0.60662	0.299986	-2.02216	0.046342 **
OPENESS_I	-0.0027	0.020327	-0.1326	0.89483
RER	0.052899	0.058716	0.900932	0.370201
C	0.005777	0.027139	0.212874	0.831941
Effects Specification				
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				

## Appendix H. Robustness; Direct Growth Effect of Flexibility

As a robustness check, Table A.8 shows a direct effect of effective technological flexibility in the growth equation. The estimated coefficients on  $\sigma^{eff}$  are unstable across lags and alternate in sign, and the implied long-run effect is economically negligible and statistically insignificant. This pattern is inconsistent with a direct growth channel and supports the view that technological flexibility affects growth only indirectly through its impact on capital returns.

**Table H1**

<b>Direct Growth Effect of Effective Technological Flexibility</b>			
<b>(Robustness Check)</b>			
L.Predicted return on capital (structural)	0.355		
	(0.653)		
L2.Predicted return on capital (structural)	-0.47		
	(0.669)		
L.Effective technological flexibility (sigma × ASI)	-0.019		
	(0.009)		
L2.Effective technological flexibility (sigma × AS)	0.017		
	(0.015)		
Log trade openness	0.006		
	-0.007		
Real depreciation proxy: $\Delta \ln FX - \Delta CPI$	0.042		
	(0.041)		
Country fixed effects	Yes		
Year fixed effects	Yes		
Long-run effect of sigma_eff (t-1 + t-2)	-0.002		
SE (long-run effect)	0.006		
Observations	115		
Countries	5		

Notes: Fixed-effects panel regressions of GDP per capita growth on lagged capital returns and effective technological flexibility ( $\sigma_{eff} = \sigma \times ASI$ ). Country and year fixed effects are included. Standard errors clustered at the country level are reported in parentheses. The long-run effect is computed as the sum of the first two lags of  $\sigma_{eff}$ . Sample restricted to high-income economies.