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Factors affecting micro, small, and medium-sized enterprise development in developing Asia: Findings from a probabilistic principal component analysis

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# FACTORS AFFECTING MICRO, SMALL, AND MEDIUM-SIZED ENTERPRISE DEVELOPMENT IN DEVELOPING ASIA

FINDINGS FROM A PROBABILISTIC PRINCIPAL  
COMPONENT ANALYSIS

*Shigehiro Shinozaki, Daisuke Miyakawa, and Romeo Araham*

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# Factors Affecting Micro, Small, and Medium-Sized Enterprise Development in Developing Asia: Findings from a Probabilistic Principal Component Analysis

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and Romeo Arahan

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## ABSTRACT

Limited data on micro, small, and medium-sized enterprises (MSMEs) make it difficult for governments to design appropriate MSME policies in Asia and the Pacific. To identify factors affecting MSME development and promote evidence-based policymaking, we propose a probabilistic principal component analysis method that works despite current data limitations. The study uses time-series MSME data collected from 25 developing member countries of the Asian Development Bank (ADB) through the Asia Small and Medium-Sized Enterprise Monitor project. The estimation results suggest that sound MSME credit markets, diversified financing options, support for new businesses and job creation, and active MSME participation in global marketplaces play a critical role in ensuring a smooth business recovery from various crises and shocks affecting developing Asia and the Pacific.

**Keywords:** SME development, access to finance, financial inclusion, SME policy, probabilistic principal component analysis, Southeast Asia, South Asia, Central and West Asia, the Pacific

**JEL codes:** D22, G20, L20, L50

## 1. Introduction

Developing Asian economies continue to recover from the coronavirus disease (COVID-19) pandemic that began in March 2020, although economic growth differs by country. Continuous global economic uncertainty, however, has amplified downside risks—including high inflation, currency depreciation, and global supply chain disruptions accelerated by regional political turbulence. In Southeast Asia, a recovery in tourism partly contributed to the region's 5.6% growth in 2022; but it is forecast to drop to 4.6% in 2023 given continued weak exports. In South Asia, economic and political crises in Pakistan and Sri Lanka pushed the region's growth down from 6.7% in 2022 to 5.4% in 2023. In Central and West Asia, the ongoing impact from the Russian invasion of Ukraine helped lower the region's growth from 5.1% in 2022 to a forecast 4.6% in 2023. In the Pacific, a strong post-pandemic tourism rebound energized the region's sharp economic recovery to 6.1% growth in 2022; but it is forecast to slow to 3.5% in 2023 partly due to labor shortages accelerated by emigration from small island countries to Australia and New Zealand (ADB 2023a).

Micro, small, and medium-sized enterprises (MSMEs) help drive growth across developing Asia and the Pacific, given their large share of business enterprises, job creation, and economic output. Given their impact, governments in the region have taken several policy measures to promote MSME development. They commonly promote entrepreneurial development (especially for youth and women), use of technology that encourages business innovation, expanded market access by internationalizing MSMEs, human capital and skills development, and better access to finance. But constraints on MSME development remain in most countries. These include a lack of an entrepreneurial culture, high dependence on cash transactions that stymie innovation, a large percentage of unregistered or informal businesses, limited exports or participation in global markets, skilled labor shortages, and structural problems limiting access to formal financial services for working and growth capital. This raises the question how governments can enhance policies and their implementation to promote MSME development toward more inclusive, resilient growth.

Better understanding the MSME business environment and structural problems that inhibit growth is critical before designing a feasible policy framework on MSME assistance. However, the lack of data on MSMEs makes this extremely difficult. To help governments promote evidence-based MSME policymaking, the Asian Development Bank (ADB) has, since 2020, provided benchmark indicators on MSME development and access to finance through its annual Asia Small and Medium-Sized Enterprise Monitor (ASM). As of November 2023, the ASM covers MSMEs in 25 ADB developing members in Southeast Asia, South Asia, Central and West Asia, and the Pacific. Insufficient data, however, remains a major problem.

A solid quantitative evaluation on MSME development using sufficient, accurate, and comparable data remains a challenge both nationally and regionally. Incomplete data on MSMEs led global institutions—such as the Organisation for Economic Co-operation and Development (OECD), the Economic Research Institute for ASEAN and East Asia (ERIA), and the International Trade Centre (ITC)—to propose a qualitative approach using assessment matrices for performance ratings or median comparisons based on available data to evaluate MSME development and competitiveness, both nationally and regionally.

The ASM project has also explored a new way to quantitatively identify factors affecting MSME development through its ASM database. In 2021, it developed a new trial that deals with MSME data limitations—a variant of a standard principal component analysis (PCA) that supplements some missing MSME data—a probabilistic PCA (ADB 2022). The pilot test covered 15 countries

from Southeast Asia and South Asia along with a firm-level data analysis for Viet Nam. While this contributed to the new MSME development index, insufficient data limited the proposed model's ability to estimate more accurately the factors that represent MSME activities. More test-runs for additional countries are needed to produce a reliable index conducive to evidence-based policy design on MSMEs in the region. In 2023, we successfully compiled time-series MSME data covering 25 countries. With this new dataset, this study re-estimates factors that explain the MSME development path by region and country and rethinks how to develop a quantitative approach to better assess MSME development.

Section 2 summarizes the MSME landscape in developing Asia, extracted from ADB (2023b). Section 3 reviews global MSME data initiatives in Asia and the Pacific. Section 4 explains the methodology and dataset used for analysis. Section 5 discusses the estimation results in four groups—(i) all countries, (ii) Southeast Asia, (iii) South Asia, and (iv) Central and West Asia. This is followed by associated policy implications in Section 6 and conclusions in Section 7.

## **2. MSME Landscape in Developing Asia**

MSMEs dominate the private sector in Asia and the Pacific. According to ADB (2023b), based on available data in participating countries through 2022, MSMEs in Asia and the Pacific accounted for an average 96.6% of all enterprises, 55.8% of the total workforce, and 28% of a country's economic output (Table 1). Data collected depend on the national MSME definition of each country. Most MSMEs serve small domestic markets, with many engaged in distributive trade and informal business. Cash dominates their business model and there is little incentive to grow further—categorized as “stability-oriented” firms. With a large base of informal businesses, the official MSME contribution to a country's economic output is likely well below its actual impact. Nonetheless, “growth-oriented” and innovative firms that want to expand into global markets have gradually increased across the region, although they remain a small fraction of MSMEs. Based on available data through 2022, MSME exports accounted for an average 26.3% of total export value. And MSME export growth is slowing, mainly due to the weak export environment globally. Low business diversification limits a country's growth potential, suggesting the need for creating more innovative and globalized small firms, startups, and an entrepreneurial base, both nationally and regionally.

Limited access to finance remains a chronic barrier to MSME growth. The MSME credit market remains small in Asia and the Pacific. ADB (2023b) reported that bank loans to MSMEs averaged 10.6% of a country's gross domestic product (GDP) and 22% of total bank lending. The pandemic response boosted commercial bank lending to MSMEs, provided government emergency financial assistance or strengthened new lending to MSMEs through subsidized loan programs, refinancing facilities, and special credit guarantees. Despite this, MSME nonperforming loans remained high, averaging 7.2% of total MSME bank loans in the region. The lack of alternative financing options beyond traditional bank credit limits innovation and business opportunities for viable MSMEs, startups, and entrepreneurs.

**Table 1: MSMEs in Developing Asia and the Pacific**  
(percentage share)

	All Countries	Southeast Asia	South Asia	Central and West Asia
<i>MSME development</i>				
• Number of MSMEs to total enterprises	96.6%	98.0%	99.6%	99.2%
• MSME employees to total employees	55.8%	66.4%	76.6%	51.9%
• MSME contribution to economic output	28.0%	41.2%	17.7%	41.5%
• MSME exports to total export value	26.3%	13.3%	37.4%	28.3%
<i>Access to finance (bank credit)</i>				
• MSME loans to national GDP	10.6%	13.3%	5.2%	11.1%
• MSME loans to total bank loans	22.0%	12.3%	12.5%	33.1%
• MSME NPLs to total MSME loans	7.2%	5.3%	12.1%	4.3%

GDP = gross domestic product, MSME = micro, small, and medium-sized enterprise, NPL = nonperforming loan.

Notes: Reporting countries only. Data based on latest available data until 2022. Data for all countries cover 25 countries:

10 from Southeast Asia; 5 from South Asia; 7 from Central and West Asia; and 3 from the Pacific.

Source: Asia SME Monitor 2023 database.

### 3. Global MSME Data Initiatives

Several global initiatives are developing indices to measure specific aspects of MSMEs—such as access to markets, infrastructure, finance, skills development, use of technology and innovation, business operations and administration, competitiveness, and policy and regulatory frameworks (Table 2). Multilateral organizations such as the OECD, ERIA, ITC, and World Bank Group have been using various analytical approaches to overcome the lack of sufficient MSME data.

The OECD produces two related reports on SME development: (i) the SME and Entrepreneurship Outlook and (ii) Financing SMEs and Entrepreneurships (OECD Scoreboard). Launched in 2002, the Entrepreneurship Outlook reviews 6 dimensions with 29 subdimensions using cross sectional data for median comparison. Dimensions include (i) institutional and regulatory frameworks, (ii) market conditions, (iii) infrastructure, (iv) access to finance, (v) access to skills, and (vi) access to innovation assets (OECD 2023). The subdimensions include (i) regulations, courts and laws, land and housing, public governance, competition, and taxation; (ii) domestic markets, global markets, public procurement, and trade and investment; (iii) logistics, energy, research and development (R&D) and innovation, the internet and information and communications technology (ICT); (iv) self-funding, debt, the financial system, and alternative instruments; (v) adult literacy, the labor market, entrepreneurial culture, training, and education; and (vi) technology, R&D, organization and processes, marketing, and data. It covers OECD members, including, from Asia, Australia, Japan, New Zealand, and the Republic of Korea.

The OECD Scoreboard, launched in 2012, is an annual report focusing on trends in SME financing and policies for 48 countries. In 2022, it included 11 countries from Asia—Australia, Georgia, Indonesia, Japan, Kazakhstan, Malaysia, New Zealand, the People's Republic of China (PRC), the Republic of Korea, Thailand, and Türkiye. It reviews 5 financial dimensions with 25 subdimensions (indicators): (i) allocation and structure of bank credit to SMEs; (ii) extent of public



support for SME finance; (iii) credit costs and conditions; (iv) nonbank sources of finance; and (v) financial health (OECD 2022). The OECD constructs the indicators mainly using supply-side data from standardized forms filled in by banks, other financial institutions, statistics offices, and government agencies. The core indicators include total lending (overall and SMEs), new lending (overall and SMEs), short- versus long-term SME loans, direct government SME loans, government loan guarantees, interest rates (overall and SMEs), collateral (SMEs), and bankruptcies (SMEs), among others.

The OECD and ERIA produced an ASEAN SME Policy Index in 2014 and 2018 outlining the policy landscape for SME development. It evaluates the scope and intensity of SME development policies through 8 dimensions with 25 subdimensions: (i) productivity, technology, and innovation; (ii) environmental policies targeting SMEs; (iii) access to finance; (iv) access to markets and internationalization; (v) institutional framework; (vi) legislation, regulation, and taxes; (vii) entrepreneurial education and skills; and (viii) social enterprises and inclusive entrepreneurship (OECD and ERIA 2018). These are measured in three stages: (i) planning and design; (ii) implementation; and (iii) monitoring and evaluation. Participating governments share their SME data and assess SME policies. They also conduct surveys of key stakeholders and private sector representatives to help supply missing information needed for qualitative analysis. For each subdimension, respondents score the strengths and weaknesses of current SME policies on a scale from 1 to 6, with higher scores indicating a better level of policy development and implementation.

The ITC's SME Competitiveness Outlook annually reviews SME development and financing conditions in 85 countries including several from Asia (ITC 2022). It aims to facilitate implementation of United Nations Sustainable Development Goals 8 and 9. The report produces an SME Competitiveness Index based on 3 dimensions with 39 subdimensions: (i) firm capabilities (SME's ability to manage resources under its control); (ii) business ecosystem (resources and competencies needed to enhance a firm's competitiveness); and (iii) national environment (government functionality and policy implementation). Each dimension is measured on three abilities: (i) capacity to compete (enterprise efficiency); (ii) capacity to connect (information and knowledge gathering/exploitation); and (iii) capacity to change (human and financial capital investments). The index assesses the competitive strengths and weaknesses by firm size on a 0–100 scale, analyzing time-series data obtained from secondary data including (i) the World Bank's Enterprise Surveys, Ease of Doing Business Index, and Logistics Performance Index; (ii) the International Monetary Fund's (IMF) World Economic Outlook; and (iii) the ITC's Market Access Map. Firm size classifications use the definition from World Bank Enterprise Surveys.<sup>1</sup> Strengths and weaknesses are measured based on a reference level of per capita GDP.

As mentioned, the World Bank Group regularly releases three related reports: (i) the International Finance Corporation (IFC) MSME Finance Gap Report; (ii) the Enterprise Surveys; and (iii) the Doing Business report. The latest IFC report was released in 2017 (with updates as needed), covering 128 countries including 29 ADB developing members (IFC 2017). Data cover general indicators such as MSME landscape, bank lending, and nonbank finance data. It estimates the potential demand for financing in emerging economies compared with current supply, and calculates the "finance gap." The report is considered a benchmark of MSME financing needs in 10 advanced economies. MSME categories include industry (manufacturing, services, or retail),

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<sup>1</sup> The Enterprise Surveys define small firms as having 5-19 employees, medium firms 20-99, and large firms 100+ employees. <https://www.enterprisesurveys.org/en/methodology>.

size, and age. The World Bank Enterprise Surveys furnish the data necessary in conjunction with benchmarking for estimating the potential demand for MSME finance.

The World Bank's Doing Business report offers thematic firm-level data for more than 130 countries covering five dimensions: (i) starting a business; (ii) hiring and firing workers; (iii) enforcing a contract; (iv) getting credit; and (v) closing a business. The report was discontinued in 2021 to be replaced by the Business Enabling Environment (BEE) Project (as of December 2022). BEE will focus on similar indicators, adding an indicator on market competition and removing the section on protecting minority investors. BEE will add analyses on digital adoption, environmental sustainability, and gender equality.

Although not focusing on MSMEs, other global initiatives on developing relevant indices include (i) the Global Competitiveness Index from the World Economic Forum (WEF); (ii) the Global Innovation Index from the World Intellectual Property Organization (WIPO); and (iii) the Global Entrepreneurship Index from the Global Entrepreneurship and Development Institute (GEDI). The Global Competitiveness Index, started in 2005, covers 141 economies including several in Asia (WEF 2019). It analyses four dimensions of competitiveness, including the enabling environment, markets, human capital, and innovation ecosystem. It uses aggregate data sourced from international organizations such as the World Bank and results of the WEF Executive Opinion Survey conducted for business executives.

The Global Innovation Index was launched in 2007 as a measuring tool for innovation in a society by using cross-sectional data for median comparisons (WIPO 2022). It is subdivided into two subindices—innovation inputs and innovation outputs. The Innovation inputs sub-index offers a snapshot of society's enabling environment for innovation and innovative activities. Five areas are monitored: (i) institutions; (ii) human capital and research; (iii) infrastructure; (iv) market sophistication; and (v) business sophistication. The innovation outputs sub-index measures the results of innovative activities by evaluating (vi) knowledge and technology outputs and (vii) creative outputs. The average scores from both indices comprise the overall score. The 2022 edition covered 132 countries including several in Asia.

The Global Entrepreneurship Index measures a country's entrepreneurial ecosystem, also using cross-sectional data for median comparisons (GEDI 2019). The ecosystem is the prevailing environment an entrepreneur faces. It examines entrepreneurs in terms of attitudes, abilities, and aspirations, all predicated on the society's entrepreneurial framework—which includes market structure, infrastructure, the R&D system, financial sector, corporate sector, government, and education system. Fourteen areas are measured. A composite score is produced, and then compared nationally and regionally. The 2019 report covered 137 countries including several in Asia.

### ***Another trial for examining factors affecting MSME development***

The global MSME data initiatives reviewed above mainly use qualitative scoring methods based on national surveys with descriptive analyses and/or use median comparisons from secondary data. The limited availability of MSME data makes it difficult for direct comparisons across countries. Thus, they have tried to describe MSME conditions and identify constraints on MSME development primarily using scoring methods based on evaluation matrices that supporting governments use to design MSME policies. This study has the same purpose, but apart from these indices, applies a more quantitative approach by using panel data obtained under the Asia SME Monitor project.

**Table 2: Summary of Global MSME Data Initiatives in Asia and the Pacific**

Item	Asia Small and Medium-Sized Enterprise Monitor (ASM)	SME and Entrepreneurship Outlook	Financing SMEs and Entrepreneurs (OECD Scoreboard)	ASEAN SME Policy Index	SME Competitiveness Outlook	Global Competitiveness Index	Global Innovation Index	Global Entrepreneurship Index
Lead organization	ADB	OECD	OECD	OECD and ERIA	ITC	WEF	WIPO	GEDI
Year launched	2020	2002	2012	2014	2015	2005	2007	2006
Latest edition	2023	2023	2022	2018	2022	2019	2022	2019
Dimension	3	6	5	8	3	4	7	3
1	MSME development	Institutional and regulatory framework	Allocation and structure of bank credit to SMEs	Productivity, technology, and innovation	Firm capabilities	Enabling environment	Institutions	Entrepreneurial attitudes
2	Access to finance	Market conditions	Extent of public support for SME finance	Environmental policies targeting SMEs	Business ecosystem	Markets	Human capital and research	Entrepreneurial abilities
3	Policies and regulations	Infrastructure	Credit costs and conditions	Access to finance	National environment	Human capital	Infrastructure	Entrepreneurial aspirations
4		Access to finance	Nonbank sources of finance	Access to market and internationalization		Innovation ecosystem	Market sophistication	
5		Access to skills	Financial health	Institutional framework			Business sophistication	
6		Access to innovation assets		Legislation, regulation, and tax			Knowledge and technology outputs	
7				Entrepreneurial education and skills			Creative outputs	
8				Social enterprises and inclusive entrepreneurship				
Sub-dimension	15	29	25	25	39	12	81	14
Data	Cross-sectional and time series	Cross-sectional and time series	Cross-sectional and time series	Cross-sectional (intent to create a time series)	Cross-sectional and time series	Cross-sectional and time series	Cross-sectional	Cross-sectional
Methodology	Quantitative and qualitative national surveys	Median comparison	Descriptive national surveys	Qualitative national surveys	Median comparison	Quantitative and qualitative national surveys	Median comparison	Median comparison
Participating economies	25 developing economies: (i) Southeast Asia (10); (ii) South Asia (5); (iii) Central and West Asia (7); and (iv) Pacific (3).	OECD member economies (including Australia, Japan, New Zealand, and the Republic of Korea).	48 economies (including Australia, Georgia, Indonesia, Japan, Kazakhstan, Malaysia, New Zealand, the PRC, the Republic of Korea, Thailand, and Türkiye).	10 ASEAN member states	85 economies (including Armenia, Azerbaijan, Bangladesh, Bhutan, Cambodia, Georgia, Indonesia, Kazakhstan, the Kyrgyz Republic, the Lao PDR, Mongolia, Myanmar, Nepal, Pakistan, the Philippines, Tajikistan, Timor-Leste, Türkiye, and Viet Nam).	141 economies (including Armenia; Australia; Azerbaijan; Bangladesh; Brunei Darussalam; Cambodia; the PRC; Georgia; Hong Kong, China; Indonesia; India; Japan; Kazakhstan; the Republic of Korea; the Kyrgyz Republic; the Lao PDR; Malaysia; Mongolia; Nepal; Pakistan; the Philippines; Singapore; Sri Lanka; Tajikistan; Thailand; Türkiye; and Viet Nam).	132 economies (including Armenia; Australia; Azerbaijan; Bangladesh; Brunei Darussalam; Cambodia; the PRC; Georgia; Hong Kong, China; Indonesia; India; Japan; Kazakhstan; the Republic of Korea; the Kyrgyz Republic; the Lao PDR; Malaysia; Mongolia; Nepal; Pakistan; the Philippines; Singapore; Sri Lanka; Tajikistan; Thailand; Türkiye; Uzbekistan; and Viet Nam).	137 economies (including Armenia; Australia; Azerbaijan; Bangladesh; Brunei Darussalam; Cambodia; the PRC; Georgia; Hong Kong, China; Indonesia; India; Japan; Kazakhstan; the Republic of Korea; the Kyrgyz Republic; the Lao PDR; Malaysia; Myanmar; Pakistan; the Philippines; Singapore; Tajikistan; Thailand; Türkiye; and Viet Nam).
Remarks	Country and regional reviews	SME performance and the degree of entrepreneurship	Finance and entrepreneurship scoreboard	Policy landscape relates to SME development and policy implementation	SME competitiveness at the macro level	Competitiveness and economic productivity	Innovation trends and analysis	Entrepreneurship ecosystem

ADB = Asian Development Bank; ASEAN = Association of Southeast Asian Nations; ERIA = Economic Research Institute for ASEAN and East Asia; GEDI = Global Entrepreneurship and Development Institute; ITC = International Trade Centre; Lao PDR = Lao People's Democratic Republic; MSME = micro, small, and medium-sized enterprise; OECD = Organisation for Economic Co-operation and Development; PRC = People's Republic of China; WEF = World Economic Forum; WIPO = World Intellectual Property Organization.

Source: Authors. Updates as of 30 October 2023.

## 4. Methodology and Dataset

Given MSME data limitations, a model was developed using a probabilistic principal component analysis (P-PCA), combined with estimating the expectation-maximization (EM) algorithm to compensate for missing data. The exercise used the ADB Asia SME Monitor 2023 database.<sup>2</sup> The following sections explain the structure of the data used and the model specifications.

### 4.1. Data Structure

The Asia SME Monitor database stores various MSME-related aggregate variables, covering 25 countries as of November 2023—10 in Southeast Asia (Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic [Lao PDR], Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam); 5 in South Asia (Bangladesh, India, Nepal, Pakistan, and Sri Lanka); 7 in Central and West Asia (Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan), and 3 in the Pacific (Fiji, Papua New Guinea, and Samoa).<sup>3</sup>

The database covers three dimensions: (i) the MSME landscape—14 data categories including the number of MSMEs, those employed by MSMEs, contribution to economic output (whether in GDP or gross value added), and MSME export/import values; (ii) MSME access to bank credit—8 data categories including MSME bank loans outstanding, nonperforming MSME loans, and guaranteed loans; and (iii) MSME access to nonbank and market-based finance—8 data categories including nonbank finance institution (NBFI) finance (including microfinance institutions, finance companies, credit cooperatives, and pawnshops), nonperforming financing, and the market capitalization MSMEs can tap. All local currency data were converted into US dollars, referring to end-of-year currency rates from the IMF International Financial Statistics for designated years. The data covers 2007–2022.

Data with sufficient observations are used as independent variables to estimate the latent variable “MSME development” under the P-PCA model.<sup>4</sup> There are two groups of variables incorporated into the model: nonfinance and finance data. For nonfinance data, the variable “number of MSMEs” is the number of enterprises meeting the MSME criteria for each country and year. It indicates the net data provided by national statistics agencies and does not show details of a firm’s “scrap-and-build” conditions, but an increased number roughly suggests newly created businesses. The variable “number of employees” measures the number of workers employed by the MSMEs in each country and year. “MSME output” measures the sum of value-added produced by MSMEs in each country and year. The variables “MSME exports” and “MSME imports” show the value of products exported and imported by MSMEs in each country and year.

Finance-related variables measure the state of corporate financing in each country and year. The variables “MSME loans outstanding” and “nonperforming MSME loans” correspond to the outstanding amounts of bank loans to MSMEs and the amount of nonperforming loans. Given that data on MSME bank loans are unavailable for some countries, “bank loans outstanding” and “nonperforming bank loans” are included in the datasets, as these include MSME borrowers. The variables “NBFI loans outstanding” and “nonperforming NBFI loans” also refer to loans from nonbank finance institutions available for MSMEs. The variable “market capitalization” is the

<sup>2</sup> ADB Asia SME Monitor 2023 database. <https://data.adb.org/dataset/2023-asia-small-and-medium-sized-enterprise-monitor>.

<sup>3</sup> Myanmar was excluded after 2020 for the data update. Effective 1 February 2021, ADB placed a temporary hold on sovereign project disbursements and new contracts in Myanmar.

<sup>4</sup> In the case of an extremely small number of observations, P-PCA estimates display “errors.”

market value of listed companies on dedicated MSME market boards or equity markets that MSMEs can tap in each country and year. For countries without dedicated MSME markets or where MSME market data are unavailable, main market data are used, given that equity financing is an important external financing source for MSMEs.

Appendix 1 summarizes each variable for each country. The number of available variables varies by country. Although the range of available data has largely improved compared with the 2021 pilot test, even country-level aggregate variables are not commonly available for all countries. In addition, the number of observations for each variable varies for each country, creating missing values in certain variables (Appendix 2). These facts support the use of the P-PCA method for this study.

## 4.2. Regression Models

### *Probabilistic principal component analysis*

Missing data is always an issue for data analysis. The P-PCA, while a derivation of principal component analysis, has been used to solve problems and issues relating to missing data across different sectors in social science and engineering by analyzing, predicting, or detecting variables of interest.

Several studies have focused on the effectiveness of P-PCA in imputing for missing data by running experiments and comparing results by using other methods of imputing missing data. For instance, Hegde et al. (2019) conducted an experiment where some data points were deliberately omitted. P-PCA was used to estimate whether the predicted values would be closest to the original data and then compared the results using multiple imputation using chained equations (MICE). The experiment showed that P-PCA was the better statistical tool for imputing missing completely at random (MCAR) data than MICE. Another experiment run by Jenelius and Koutsopoulos (2017) tried to predict taxi travel times in urban networks using P-PCA and k-nearest neighbors. It revealed that the results of P-PCA provided more accurate predictions.

P-PCA was also used to input missing data for image analysis and reconstruction. Yu et al. (2010) utilized P-PCA to impute missing data that would help reconstruct 3D images. Employing an algorithm using P-PCA and expectation maximization proved an effective way to reconstruct 3D images. Cao, Liu, and Yang (2008) used P-PCA to help detect small infrared targets by helping map the input vector from the image onto a subspace. It better predicted the possibility of the input being a target.

Other experiments utilized P-PCA to detect and filter out abnormal data and outliers. This was pivotal in addressing data issues, such as identifiability issues and removal of bias in the analysis. Qu et al. (2009) used robust PCA to filter out abnormal traffic flow data and compared it to other methods such as the nearest/mean historical imputation method and local interpolation/regression method. Compared with other methods, it showed P-PCA reduced the root-mean-square imputation error by at least 25%. Chen, Martin, and Montague (2009) successfully used P-PCA as a tool to detect outliers and were able to run contribution analysis after yielding the missing data. Their research showed that P-PCA was critical in identifying the source of the outliers, thereby improving their analysis. Xiang, Zhong, and Gao (2015) used P-PCA to better detect rolling element bearing faults and then conducted spectral kurtosis to determine the optimal center frequency and bandwidth. Ma et al. (2021) used P-PCA to create a base model to detect anomalies and identify structural damage in buildings. The experiment proved that P-PCA is effective in recovering missing data to conduct the analysis.

Advances in data science and analysis require using machine learning and neural networks to support sophisticated processes. This allows P-PCA to be used in conjunction with more advanced tools to achieve research goals. Dixit, Bhagat, and Dangi (2022) were successful in integrating P-PCA in detecting fake news. P-PCA was utilized to improve the filtering process of news after initial manual filtering. By automating the process, the authors were able to detect and classify fake news using long short-term memory networks.

Overall, P-PCA has been an effective tool in imputing missing data that allows for predictive modelling, anomaly and outlier detection, and in improving data analysis across different sectors in social sciences and engineering. It has worked better than other missing data estimation techniques. Combined with other sophisticated data analysis methodologies, P-PCA helps increase accuracy and reduces errors.

### Concept of P-PCA

This section provides a detailed explanation of the P-PCA model developed for this study, referring to Tipping and Bishop (1999), Bishop (2006), and Hastie et al. (2009).<sup>5</sup> The P-PCA is a variant of a standard PCA that allows for some missing data, assuming that every observed data  $x \in \mathbb{R}^d$  correspond to a latent variable  $z \in \mathbb{R}^{d'}$  and are generated by the following linear model:

$$x = Wz + \mu + \epsilon, \quad (1)$$

where matrix  $W \in \mathbb{R}^{d \times d'}$  relates the latent variable to the observed data,  $\mu \in \mathbb{R}^d$  is the mean of this model, and  $\epsilon$  is the noise. The distribution of  $z$  is the  $k$ -dimensional standard Gaussian  $N(0, I)$ , while  $\epsilon$  comes from the Gaussian  $N(0, \sigma^2 I)$ . When there is  $n$  observed data  $\{x_i\}_{i=1}^n$ , the latent variable and a noise corresponding to  $x_i$  are written as  $z_i$  and  $\epsilon_i$ , respectively. For simplicity,  $X = (x_1, x_2, \dots, x_n)^T \in \mathbb{R}^{n \times d}$  and  $Z = (z_1, z_2, \dots, z_n)^T \in \mathbb{R}^{n \times d'}$ , and each  $x_i$  is regarded as identically and independently sampled from model (1). Thus, model (1) assumes the observed data is realized by the low dimensional ( $d' < d$ ) latent variable. The goal is to find optimal parameters  $(\mu, W, \sigma^2)$  to maximize the posterior likelihood. Before applying the analysis,  $X$  is regularized into mean 0 and variance 1 for each column.

Under these premises, the observed variable  $s_i$  follows its marginal distribution  $x_i \sim N(\mu, WW^T + \sigma^2 I)$  (independent and identically). Thus, the following log likelihood function is generated, where  $X$  is regularized as the zero-mean in the following transformation:

$$\begin{aligned} \mathcal{L} &= \sum_{i=1}^n -\frac{1}{2} \left[ \log \det (WW^T + \sigma^2 I) + (x_i - \mu)^T (WW^T + \sigma^2 I)^{-1} (x_i - \mu) \right] \\ &= -\frac{1}{2} \left[ n \log \det (WW^T + \sigma^2 I) + n\mu^T (WW^T + \sigma^2 I)^{-1} \mu + \sum_{i=1}^n x_i^T (WW^T + \sigma^2 I)^{-1} x_i \right], \quad (2) \end{aligned}$$

where the independent terms for the maximum likelihood estimation are omitted.

According to Tipping and Bishop (1999), the optimal parameters that attain the maximal of  $L$  can be explicitly written. Here, the eigenvalue decomposition of the covariance matrix of  $X$  is used.

<sup>5</sup> The methodology is explained in ADB (2022, pp. 4–7). As the same analytical estimation process was followed using expanded datasets through 2022, the same explanation applies here.

Let  $(v_1, \lambda_1), \dots, (v_d, \lambda_d)$  be sets of eigenvector and eigenvalue of  $X^T X$  sorted in order of increasing eigenvalues. With  $U = (v_1, \dots, v_d)$  and  $\Lambda = (\lambda_1, \dots, \lambda_d)$ , these notations bring the following solution for the maximum likelihood estimation:

$$\begin{cases} \mu_* = 0 \\ W_* = U(\Lambda - \sigma^2 I)^{\frac{1}{2}} R \quad \left( R \in \mathbb{R}^{d' \times d'} \text{ is an arbitrary rotation matrix} \right) \\ \sigma_*^2 = \frac{1}{d - d'} \sum_{i=d'+1}^d \lambda_i. \end{cases} \quad (3)$$

### Using expectation–maximization algorithm

Apart from the explicit solution to equation (3), there are several useful iterative algorithms to solve optimization problems. The gradient descent method is probably the most popular algorithm for optimization. The expectation-maximization (EM) algorithm introduced here assures that  $L$  does not decrease in each step.

In the following exposition, we denote a set of parameters  $(\mu, W, \sigma^2)$  as  $\theta$ , and subscript the parameters of the  $k$ -th iteration as  $\theta_k (k = 1, 2, \dots)$ . However, a more generalized setting is considered where the random variables  $x$  and  $z$  follow a joint distribution  $p(x, z|\theta)$ , but only  $x$  can be observed. We draw  $n$  data  $\{x_i\}_{i=1}^n$  identically and independently from  $p(x, z|\theta)$ . To apply the maximum likelihood estimation to derive  $\theta_k$ , the objective function can be written as follows:

$$\begin{aligned} \mathcal{L}(\theta) &= \log p(X|\theta) \\ &= \int p(Z|X, \theta_k) \log p(X|\theta) \, dZ \\ &= \int p(Z|X, \theta_k) \log \frac{p(X, Z|\theta)}{p(Z|X, \theta_k)} \, dZ + \int \log p(Z|X, \theta_k) \log \frac{p(Z|X, \theta_k)}{p(Z|X, \theta)} \, dZ \\ &= \int p(Z|X, \theta_k) \log \frac{p(X, Z|\theta)}{p(Z|X, \theta_k)} \, dZ + \text{KL}(p(Z|X, \theta_k) \parallel p(Z|X, \theta)). \end{aligned}$$

The EM algorithm aims to maximize the first term so that the following equation holds:

$$\theta_{k+1} = \arg \min_{\theta} \int p(Z|X, \theta_k) \log \frac{p(X, Z|\theta)}{p(Z|X, \theta_k)} \, dZ = \arg \min_{\theta} \int p(Z|X, \theta_k) \log p(X, Z|\theta) \, dZ$$

The second term is no less than zero and attains its minimum at  $\theta = \theta_k$ . Thus, the EM algorithm assures that  $L(\theta_{k+1}) \geq L(\theta_k)$  holds for all  $k = 1, 2, \dots$  as follows:

$$Q_k(\theta) = \int p(Z|X, \theta_k) \log p(X, Z|\theta) \, dZ = \sum_{i=1}^n \int p(Z|X, \theta_k) \log p(x_i, z_i|\theta) \, dZ = \sum_{i=1}^n \int p(z|x_i, \theta_k) \log p(x_i, z_i|\theta) \, dz.$$

The second equality holds as  $(x_i, z_i)$  ( $i = 1, \dots, n$ ) is independent.

In summary, the EM algorithm alternately repeats two steps: an expectation step for  $\log p(X, Z|\theta)$  with regard to  $p(Z|X, \theta_k)$  and to calculate the  $k$ -th target function  $Q_k(\theta)$ , and a maximization step to maximize it. Although there is no guarantee of obtaining a global optimal solution, convergence of its likelihood is guaranteed by its derivation. This method is particularly useful for estimating parameters in latent variable models where the optimization of simultaneous distributions is difficult.

Applying the EM algorithm to the probabilistic PCA model, the simultaneous distributions can be written as follows:

$$p(x, z|\mu, W, \sigma^2) = \frac{1}{\sqrt{(2\pi\sigma^2)^d}} \exp\left(-\frac{\|x - Wz - \mu\|_2^2}{2\sigma^2}\right) \cdot \frac{1}{\sqrt{(2\pi)^k}} \exp\left(-\frac{\|z\|_2^2}{2}\right).$$

Then, the conditional distribution  $p(z|x_i, \theta_k)$  of  $z$  with  $k$ -th parameters is given by the following:

$$\begin{aligned} p(z|x_i, \theta_k) &\propto \exp\left(-\frac{1}{2\sigma_k^2} (z^\top (W_k^\top W_k + \sigma_k^2 I) z - 2(x_i - \mu_k)^\top W_k z)\right) \\ \therefore z|x_i, \theta_k &\sim \mathcal{N}((W_k^\top W_k + \sigma_k^2 I)^{-1} W_k^\top (x_i - \mu_k), \sigma_k^2 (W_k^\top W_k + \sigma_k^2 I)^{-1}) \end{aligned}$$

This object means that the mean  $\langle z_i \rangle$  and the covariance  $\langle z_i z_i^\top \rangle$  of  $z$  under  $p(z|x_i, \theta_k)$  can be written respectively as follows, with  $(W_k^\top W_k + \sigma_k^2 I)^{-1}$  denoted as  $M_k$ :

$$\langle z_i \rangle = M_k W_k^\top (x_i - \mu_k), \quad \langle z_i z_i^\top \rangle = \sigma_k^2 M_k + \langle z_i \rangle \langle z_i \rangle^\top$$

By extracting terms which relate to  $\theta$  from  $Q_k$ , we get the  $k$ -th target function:

$$\begin{aligned} &\sum_{i=1}^n \int p(z|x_i, \theta_k) \log p(x_i, z_i|\theta) dz - (\text{irrelevant terms}) \\ &= \frac{1}{2} \sum_{i=1}^n \int p(z|x_i, \theta_k) \left[ \log \sigma^2 + z^\top z + \frac{1}{\sigma^2} \{ (x_i - \mu)^\top (x_i - \mu) - 2(x_i - \mu)^\top W z + z_i^\top W^\top W z_i \} \right] dz \\ &= \frac{1}{2} \left[ \log \sigma^2 + \text{tr}(\langle z_i z_i^\top \rangle) + \frac{1}{\sigma^2} \{ (x_i - \mu)^\top (x_i - \mu) - 2(x_i - \mu)^\top W \langle z_i \rangle + \text{tr}(W^\top W \langle z_i z_i^\top \rangle) \} \right]. \end{aligned}$$



Finally,  $\theta_{k+1}$  is calculated by differentiating the target function by  $(\mu, W, \sigma^2)$  and finding a unique stationary point:

$$\begin{cases} \mu_{k+1} = 0 \\ W_{k+1} = \left( \sum_{i=1}^n x_i \langle z_i \rangle^\top \right) \cdot \left( \sum_{i=1}^n \langle z_i z_i^\top \rangle \right)^{-1}, \\ \sigma_{k+1}^2 = \frac{1}{n} \sum_{i=1}^n (\|x_i\|_2^2 - 2x_i^\top W_{k+1} \langle z_i \rangle + \text{tr}(W_{k+1}^\top W_{k+1} \langle z_i z_i^\top \rangle)) \end{cases}$$

under the condition  $\mu_0 = 0$ .

When the set of data  $X$  is missing some values, each  $x_i$  is decomposed into the following two terms for easier explanation:

$$x_i = I_i^s s_i + I_i^t t_i.$$

The two variables  $s_i$  and  $t_i$  correspond to the observed coordinates and missing coordinates, respectively. When  $x_i$  consists of  $u$  observed coordinates and  $v$  missing coordinates,  $(s_i)_j$  is the  $j$ -th observed coordinates of  $x_i$ , and  $(t_i)_j$  is the  $j$ -th missing coordinates of  $x_i$ . Therefore,  $s_i$  and  $t_i$  are  $u$ -dimensional and  $v$ -dimensional, while  $I_i^s (\in \mathbb{R}^{d \times u})$  and  $I_i^t (\in \mathbb{R}^{d \times v})$  are defined as follows:

$$\begin{aligned} (I_i^s)_{lj} &= \begin{cases} 1 & \text{(if } j\text{-th observed coordinate of } x_i \text{ is } x_l) \\ 0 & \text{(otherwise),} \end{cases} \\ (I_i^t)_{lj} &= \begin{cases} 1 & \text{(if } j\text{-th missing coordinate of } x_i \text{ is } x_l) \\ 0 & \text{(otherwise).} \end{cases} \end{aligned}$$

Then, the simultaneous distribution of  $s, t, z$  under fixed  $I^s$  and  $I^t$  can be written as follows:

$$p(s, t, z | \mu, W, \sigma^2) = \frac{1}{\sqrt{(2\pi\sigma^2)^d}} \exp\left(-\frac{\|I^s s + I^t t - Wz - \mu\|_2^2}{2\sigma^2}\right) \cdot \frac{1}{\sqrt{(2\pi)^k}} \exp\left(-\frac{\|z\|_2^2}{2}\right).$$

Also, there are conditional distributions about  $z$  and  $t$  under the observed  $s$ :

$$p(t, z | s, \mu, W, \sigma^2) \propto \exp\left(-\frac{1}{2\sigma^2} [z^\top t^\top] \underbrace{\begin{bmatrix} W^\top W + \sigma^2 I & -W^\top I^t \\ -(I^t)^\top & I \end{bmatrix}}_{=:D} \begin{bmatrix} z \\ t \end{bmatrix} + \frac{1}{\sigma^2} \underbrace{\left( \begin{bmatrix} W^\top \\ -(I^t)^\top \end{bmatrix} (I^s s - \mu) \right)^\top}_{=:m} \begin{bmatrix} z \\ t \end{bmatrix} \right).$$

We define and calculate  $m$  and  $D$  with the mean and variance of  $t$  and  $z$  under the fixed  $s$ . Using these distribution functions, we can derive the EM algorithm for data with missing values by regarding both  $t$  and  $z$  as latent variables.

## 5. Estimation Results

This section presents the estimation results for (i) all 25 countries, (ii) Southeast Asia, (iii) South Asia; and (iv) Central and West Asia. A regional estimation for the Pacific was not conducted as there were only 3 countries included in the model. A robustness test was done by applying another variant of P-PCA to aggregate data of the 25 countries (Appendix 4).

### 5.1. All Countries

The P-PCA was applied to country-level panel data of 25 countries to see the time-series dynamics of MSME development in Asia and the Pacific. Three factors were obtained—principal component (PC)1 to PC3 (Figure 1, Table 3). PC1 makes the largest contribution to the variation in country-level panel data (59%), followed by PC2 (15%) and PC3 (7%), explaining 80% in total (Table 4). Factor loadings are sorted in descending order (Table A3.1). A darker red color indicates a positive impact to the trend in the principal component, while a darker blue means a negative impact. Each factor is orthogonal to each other and related to each variable with specific factor loadings. Key factors that form each PC can thus be extracted.

PC1-PC3 formed three different trend curves on MSME development (Figure 1). PC1 traces a low line until the middle of the sample period, then rises from 2015 until it slows after 2020. It suggests that MSMEs felt the effects of the aftermath of the 2008–2009 global financial crisis (GFC) until 2014, when recovery accelerated until development slowed after the COVID-19 pandemic spread in 2020. Overall, it indicates “a slow recovery against the shocks.” PC2 remains low until 2011, moves up until the 2015 peak, then declines afterward. It suggests that MSMEs made relatively rapid recovery from the GFC, then decelerated development around the latter part of the 2014–2016 Russian Financial Crisis (RFC), and shifted to the negative after 2019, accelerated by the 2020–2021 COVID-19 pandemic. It indicates “relatively fast recovery against the shocks but sensitive to the shocks.” The PC3 curve is more complicated, rising soon after the GFC with its first peak in 2011, bottoming out in 2016 (RFC), and rising again afterward. It suggests “a quick recovery against the shocks but very sensitive to the shocks.”

In PC1 (**slow recovery**), the main factors slowing MSME development were nonperforming loans by banks, NBFIs, and for MSMEs (e.g., Pakistan, Kazakhstan, Brunei Darussalam, Malaysia, and Viet Nam). Negative factor loadings also indicated “MSME loans” (e.g., Tajikistan, Kazakhstan, Papua New Guinea, and Georgia), which means that increased MSME loans in some countries lowered the level of MSME development under PC1. This suggests that the delivery of low quality MSME loans with increased nonperforming loans in the countries mentioned likely contributed to MSMEs’ slow GFC recovery until 2014. In contrast, the main factors that boosted MSME development were (i) bank loans (e.g., the Philippines, Fiji, the Kyrgyz Republic, and India), (ii) number of MSMEs (e.g., Indonesia, Nepal, Georgia, Viet Nam, and the Kyrgyz Republic), and (iii) MSME output (e.g., Indonesia and Pakistan). This suggests that steady delivery of bank loans to businesses likely catalyzed the increase in number of MSMEs (new small business creation) and output, bringing MSMEs back to their growth path after 2015.

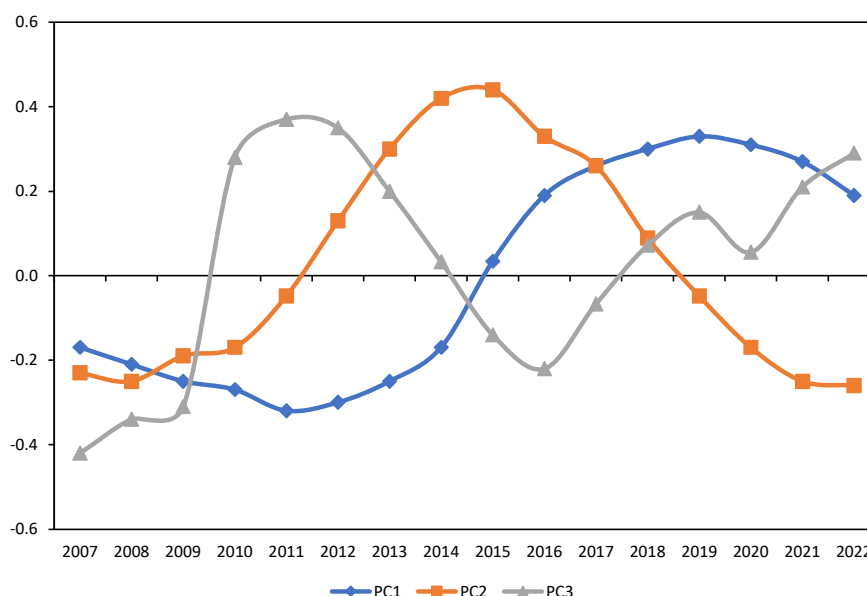
In PC2 (**relatively fast recovery**), key drivers that lowered MSME development were also nonperforming loans by banks, NBFIs, and for MSMEs (e.g., Georgia, Fiji, Bangladesh,

Uzbekistan, the Philippines, Thailand, Papua New Guinea, the Kyrgyz Republic, Viet Nam, Cambodia, and Sri Lanka). On the other hand, factors that accelerated MSME development were (i) number of MSME employees (e.g., India, Uzbekistan, Viet Nam, Georgia, Tajikistan, Malaysia, Indonesia, and the Philippines), (ii) MSME output (e.g., Tajikistan, Uzbekistan, and Georgia), (iii) MSME loans (e.g., the Lao PDR, the Philippines, Thailand, and Malaysia), and (iv) equity market capitalization (e.g., the Lao PDR, Sri Lanka, and Pakistan). PC2 suggests that nonperforming MSME loans likely slowed MSME development after the GFC and the COVID-19 pandemic, while improved delivery of MSME loans and the recovery of market-based finance resulted in a better environment for new MSME jobs and enhanced output. This likely supported the relatively fast recovery and growth of MSME businesses after the GFC.

In PC3 (**quick but sensitive recovery**), nonperforming loans by banks and for MSMEs (e.g., the Lao PDR, Indonesia, and Tajikistan) were again the main drivers slowing MSME development. Factors that raised the MSME development level were (i) bank loans (e.g., Malaysia, Thailand, Armenia, and India), (ii) market capitalization (e.g., Indonesia, Papua New Guinea, and Bangladesh), (iii) MSME output (e.g., Malaysia, Kazakhstan, Azerbaijan, Georgia, and the Kyrgyz Republic), and (iv) MSME exports and/or imports (e.g., Indonesia and the Kyrgyz Republic). Although PC3 showed a small contribution to explaining MSME development, it suggests that expanded bank lending and capital markets likely helped the rapid recovery of MSME exports and output and quickly accelerated MSME development. But due to weak financial markets and international trade for MSMEs, it remained highly sensitive to shocks like the GFC, RFC, and COVID-19 pandemic.

Overall, the estimation results for all countries show that sound MSME credit markets, diversified financing options (market-based finance), support for new business development and job creation, along with active MSME participation in global markets play a critical role for the smooth recovery from crises and shocks in developing Asia and the Pacific. Sound, resilient finance sector development is indispensable for sustainable MSME growth nationally.

**Figure 1: Time Series Plots of Estimated Principal Components—All Countries**



PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

**Table 3: Time Series Plots of Estimated Principal Components—All Countries**

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
PC1	-0.17	-0.21	-0.25	-0.27	-0.32	-0.30	-0.25	-0.17	0.03	0.19	0.26	0.30	0.33	0.31	0.27	0.19
PC2	-0.23	-0.25	-0.19	-0.17	-0.05	0.13	0.30	0.42	0.44	0.33	0.26	0.09	-0.05	-0.17	-0.25	-0.26
PC3	-0.42	-0.34	-0.31	0.28	0.37	0.35	0.20	0.03	-0.14	-0.22	-0.07	0.07	0.15	0.06	0.21	0.29

PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

**Table 4: Contribution of Each Estimated Principal Component—All Countries**

Item	PC1	PC2	PC3
Contribution ratio	0.59	0.15	0.07
Cumulative contribution rate	0.59	0.74	0.80

PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

## 5.2. Southeast Asia

For Southeast Asia, three PC factors (PC1-PC3) were also obtained (Figure 2, Table 5). PC1 makes the largest contribution to the variation in country data (59%), followed by PC2 (16%) and PC3 (7%), explaining 82% in total (Table 6). Factor loadings are sorted in descending order (Table A3.2).

PC1-PC3 in Southeast Asia followed similar trend curves as in “all countries” but with somewhat more complicated shapes (Figure 2). PC1 remains low until 2014, then rises to a 2017 peak, before decelerating growth with a drop in 2022. It indicates a slow recovery path from the GFC. PC2 also remains low until 2011, moves up until the peak in 2014, and then declines afterward—reaching its peak a year earlier than in “all countries.” It indicates a fast recovery from the GFC but sensitive to shocks such as the RFC and the pandemic. PC3 generated a complicated shape with frequent ups and downs during 2007–2022. It bottoms out in 2011, moves up to a peak in 2014, then falls until 2018 before rising again to a peak in 2021. It indicates that MSME development is very sensitive to shocks such as the GFC, RFC, and the pandemic, while also quickly recovering.

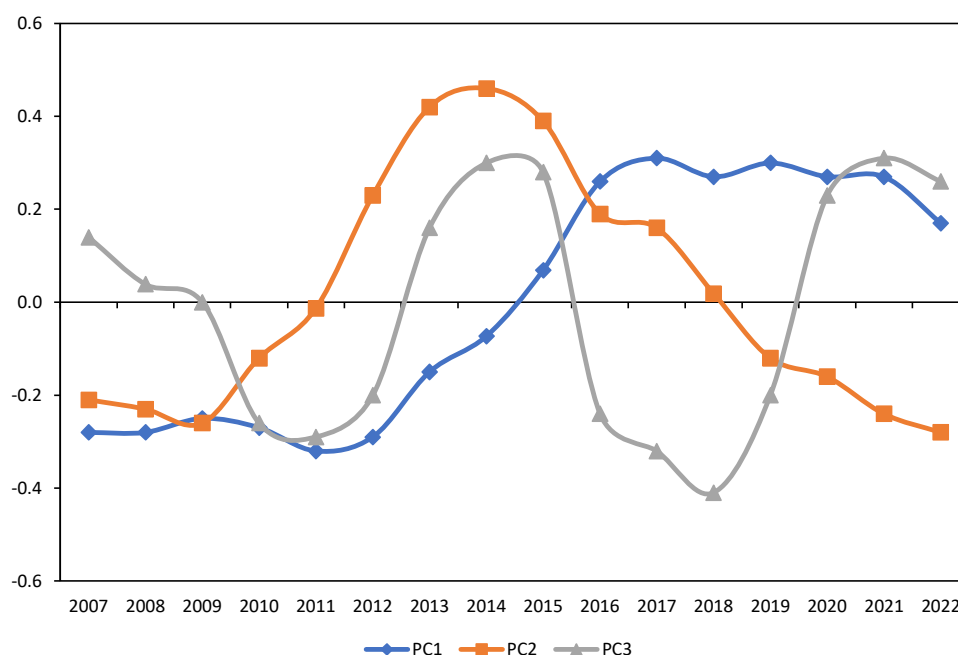
In PC1 (**slow recovery**), the negative curve until 2014 is explained by negative factor loadings denoted by nonperforming loans by banks and for MSMEs (e.g., Brunei Darussalam, Malaysia, Viet Nam, and the Philippines). In contrast, the positive curve after 2015 is explained by positive factor loadings denoted by (i) bank loans and NBFIs (e.g., the Philippines, Viet Nam, the Lao PDR, Thailand, and Singapore), (ii) number of MSMEs (e.g., Indonesia and Viet Nam), and (iii) MSME output (e.g., Indonesia, Brunei Darussalam, and Thailand). PC1 suggests that increased nonperforming loans likely contributed to their slow recovery from the GFC. But improved lending by banks and NBFIs likely facilitated new small business creation and a rebound in output, allowing a return to development growth after 2015.

In PC2 (**fast recovery**), the negative curve until 2011 and after 2019 is also explained by negative factor loadings denoted by nonperforming loans by banks, NBFIs, and for MSMEs (e.g., Thailand, Viet Nam, Myanmar, Cambodia, and the Philippines). The positive curve peaking in 2014 is explained by positive factor loadings denoted by (i) MSME loans (e.g., the Lao PDR, the Philippines, Thailand, and Malaysia), (ii) market capitalization (e.g., the Lao PDR, Singapore, and Thailand), and (iii) number of MSME employees (e.g., Viet Nam, Malaysia, the Philippines, and Indonesia). PC2 suggests that the high level of nonperforming loans in the finance sector likely

impeded MSME development around the GFC and the pandemic, while expanded MSME lending, the capital market recovery (including dedicated MSME equity markets such as *Catalist* in Singapore and *mai* in Thailand), along with more MSME jobs likely helped the relatively fast MSME development post GFC.

In PC3 (**sensitive recovery**), the negative curve around two points in 2011 and 2018 is explained by negative factor loadings denoted by (i) nonperforming loans by banks, NBFIs, and for MSMEs (e.g., the Lao PDR, Singapore, Brunei Darussalam, Thailand, and Viet Nam) and (ii) MSME loans (e.g., Thailand, the Philippines, and the Lao PDR). The positive curve around two points in 2014 and 2021 is explained by positive factor loadings denoted by (i) loans by banks, NBFIs, and MSME lending (e.g., Singapore, Brunei Darussalam, and Cambodia) and (ii) market capitalization (e.g., Malaysia [ACE and LEAP markets] and the Philippines [SME Board]). PC3 generated a different curve than for “all countries”, more pronounced in the effect of access to finance. It suggests that low quality MSME loans with increased nonperforming loans in countries such as Thailand and the Lao PDR likely kept MSME development suppressed in the region (especially in 2016–2018 amid the global economic slowdown). But diversified financing options from bank credit along with nonbank and market-based finance likely helped MSMEs recover from the shocks smoothly, while volatile financial markets held back resilience.

**Figure 2: Time Series Plots of Estimated Principal Components—Southeast Asia**



PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

**Table 5: Time Series Plots of Estimated Principal Components—Southeast Asia**

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
PC1	-0.28	-0.28	-0.25	-0.27	-0.32	-0.29	-0.15	-0.07	0.07	0.26	0.31	0.27	0.30	0.27	0.27	0.17
PC2	-0.21	-0.23	-0.26	-0.12	-0.01	0.23	0.42	0.46	0.39	0.19	0.16	0.02	-0.12	-0.16	-0.24	-0.28
PC3	0.14	0.04	0.00	-0.26	-0.29	-0.20	0.16	0.30	0.28	-0.24	-0.32	-0.41	-0.20	0.23	0.31	0.26

PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

**Table 6: Contribution of Each Estimated Principal Component—Southeast Asia**

Item	PC1	PC2	PC3
Contribution ratio	0.59	0.16	0.07
Cumulative contribution rate	0.59	0.75	0.82

PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

### 5.3. South Asia

In South Asia, three factors were obtained from the P-PCA, but PC1 and PC2 trends were swapped (Figure 3, Table 7). PC1 makes the largest contribution to the variation in country data (59%), followed by PC2 (22%) and PC3 (8%), explaining 89% in total (Table 8). Factor loadings are sorted in descending order (Table A3.3).

PC1-PC3 in South Asia generated different trend curves from “all countries” estimates (Figure 3). PC1 remains low until 2010, moves up until its 2014 peak, and then declines afterward. It indicates a fast recovery from the GFC (a year earlier than the trend in “all countries”) but was sensitive to the global economic slowdown and the pandemic. PC2 remains low until 2015, then rises through 2019, before declining until 2021. It indicates a slow recovery from the GFC and South Asia’s economic slowdown. The PC3 trend was somewhat reversed from the trend in “all countries.” It bottoms out in 2013, moves up to a peak in 2017, then drops afterward bottoming out in 2022. It indicates MSME development was sensitive to the region’s economic and political instability (e.g., India before the current administration started in 2014, and economic and political crises in Pakistan and Sri Lanka from around 2019) as well as the shock from the pandemic.

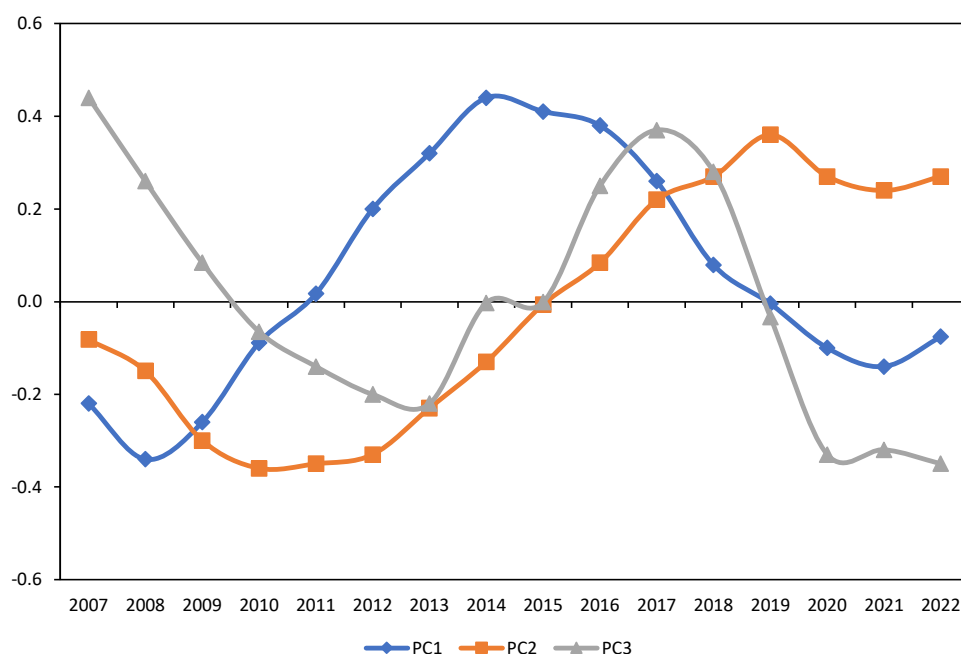
In PC1 (**fast recovery**), the negative curve until 2010 and after 2019 is explained by negative factor loadings denoted by nonperforming loans by banks, NBFIs, and for MSMEs (e.g., India, Bangladesh, Pakistan, and Sri Lanka). MSME loans in India and Pakistan were also identified as negative factors, suggesting that the delivery of low quality MSME loans with high levels of nonperforming loans in these countries likely impeded MSME development in the region. The positive curve peaking in 2014 is explained by positive factor loadings denoted by (i) NBFIs loans and market capitalization (e.g., Sri Lanka, Pakistan, and Bangladesh) and (ii) number of MSME employees (e.g., India and Nepal). A recovery in nonbank and market-based finance, along with increased MSME jobs, likely supported a smooth shift back to growth. But the MSME funding environment was likely sensitive to economic and political environment changes, especially after 2019.

In PC2 (**slow recovery**), the negative curve until 2015 is explained by negative factor loadings denoted by MSME loans and nonperforming loans by banks, NBFIs, and for MSMEs in Pakistan and India, suggesting that increased MSME loans accompanying rising nonperforming loans in these countries likely made MSMEs recover slowly from the GFC and the region’s stagnant economic growth. The positive curve after 2016 is explained by positive factor loadings denoted by (i) loans by banks and for MSMEs (e.g., Bangladesh, Pakistan, Sri Lanka, and India), (ii) number of MSMEs (e.g., Nepal), and (iii) MSME output (e.g., Bangladesh and Pakistan). After 2016, improved bank lending and MSME loans along with an environment conducive to new small businesses and better productivity likely boosted MSME development.

In PC3 (**sensitive recovery**), the negative, downward trend during 2010–2013 and after 2019 (economic crises in Pakistan and Sri Lanka) is explained by negative factor loadings denoted by

nonperforming loans by banks and NBFIs (e.g., Sri Lanka, Pakistan, and Bangladesh). The positive curve before the GFC and during 2016–2018 (linked to the new administration in India) is explained by positive factor loadings denoted by MSME loans and NBFIs loans (e.g., Pakistan, Bangladesh, and India). PC3 was more affected by access to finance for MSME development. It suggests that high levels of nonperforming loans by banks and NBFIs likely led to a slowdown in MSME development. But once the MSME credit market and the nonbank finance industry expanded, MSME development quickly turned positive, although its growth pattern was likely highly sensitive to shocks, such as regional economic crises, political conditions, and the pandemic.

**Figure 3: Time Series Plots of Estimated Principal Components—South Asia**



PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

**Table 7: Time Series Plots of Estimated Principal Components—South Asia**

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
PC1	-0.22	-0.34	-0.26	-0.09	0.02	0.20	0.32	0.44	0.41	0.38	0.26	0.08	-0.004	-0.10	-0.14	-0.08
PC2	-0.08	-0.15	-0.30	-0.36	-0.35	-0.33	-0.23	-0.13	-0.006	0.08	0.22	0.27	0.36	0.27	0.24	0.27
PC3	0.44	0.26	0.08	-0.07	-0.14	-0.20	-0.22	-0.003	-0.001	0.25	0.37	0.28	-0.03	-0.33	-0.32	-0.35

PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

**Table 8: Contribution of Each Estimated Principal Component—South Asia**

Item	PC1	PC2	PC3
Contribution ratio	0.59	0.22	0.08
Cumulative contribution rate	0.59	0.80	0.89

PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

## 5.4. Central and West Asia

As in other regions, three factors were obtained in Central and West Asia from the P-PCA (Figure 4, Table 9). PC1 makes the largest contribution to the variation in country data (63%), followed by PC2 (15%) and PC3 (8%), explaining 85% in total (Table 10). Factor loadings are sorted in descending order (Table A3.4).

PC1-PC3 show similar trends on MSME development as those in “all countries” (Figure 4). PC1 remains low until 2014, rising in 2015–2018 before slowing afterwards, indicating a slow recovery from the GFC. PC2 remains low until 2010, rises to a 2015 peak, and then declines with a negative curve after 2019, indicating a relatively rapid recovery from the GFC but sensitive to shocks like the RFC and the pandemic. PC3 bottoms out in 2009 (GFC), peaks in 2011, then drops until 2016 (RFC). It rises afterward with erratic movement during the pandemic, suggesting a quick but very sensitive recovery from shocks.

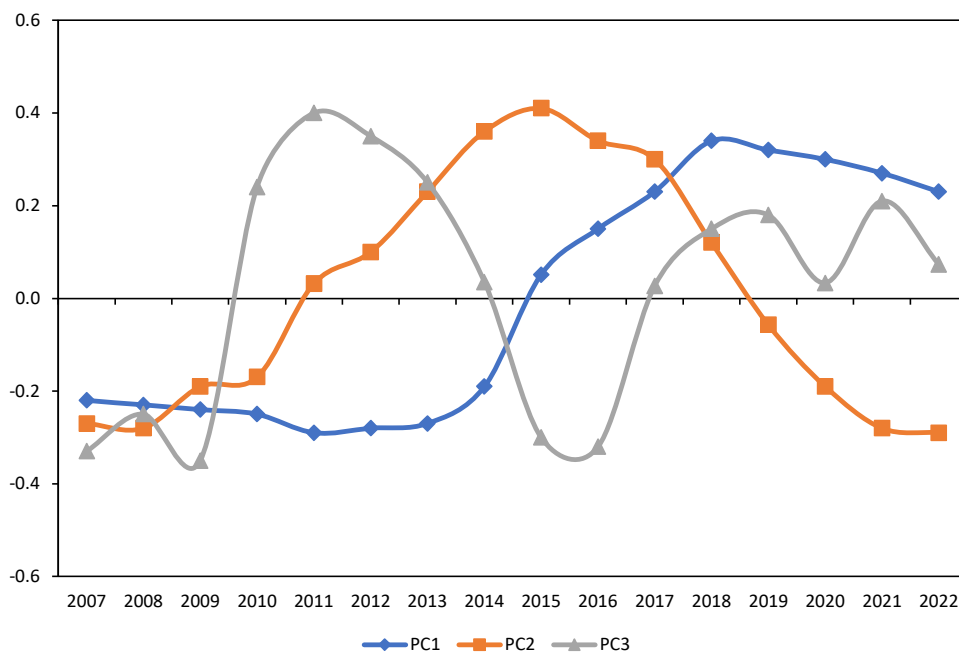
In PC1 (**slow recovery**), the negative curve until 2014 is explained by negative factor loadings denoted by (i) nonperforming bank loans (e.g., Kazakhstan, Azerbaijan, and Uzbekistan) and (ii) MSME loans (e.g., Kazakhstan, Tajikistan, and Georgia). The positive curve after 2015 is explained by positive factor loadings denoted by (i) bank loans and those for MSMEs (e.g., the Kyrgyz Republic, Armenia, and Georgia), (ii) number of MSMEs (e.g., Georgia, the Kyrgyz Republic, and Kazakhstan), and (iii) number of MSME employees (e.g., Azerbaijan, Kazakhstan, and Georgia). PC1 suggests that increased MSME lending with high levels of nonperforming loans in countries such as Kazakhstan likely slowed the recovery from the GFC. But improved bank lending likely supported creating new MSMEs and jobs in countries such as Georgia, helping them shift to growth.

In PC2 (**fast recovery**), the negative curve until 2010 and after 2019 is explained by negative factor loadings denoted by nonperforming loans by banks, NBFIs, and for MSMEs (e.g., Uzbekistan, Georgia, and the Kyrgyz Republic). The negative curve largely reflected the trends in Uzbekistan. The positive curve during 2011–2018—peaking in 2015—is explained by positive factor loadings denoted by (i) number of MSME employees (e.g., Uzbekistan, Georgia, and Tajikistan), (ii) MSME output (e.g., Tajikistan, Uzbekistan, and Georgia), and (iii) MSME exports and/or imports (e.g., Uzbekistan and the Kyrgyz Republic). PC2 suggests that a high level of nonperforming loans likely impeded MSME development. Increased job creation, higher output, and internationalization of MSMEs likely helped drive MSME development.

In PC3 (**sensitive recovery**), the downward curve around the GFC and RFC is also explained by negative factor loadings denoted by nonperforming loans by banks, NBFIs, and for MSMEs (e.g., Tajikistan, Uzbekistan, and Armenia). The negative curve in the PC3 largely reflected the trends in Tajikistan. The positive curve during 2010–2014 and after 2017 is explained by positive factor loadings denoted by (i) MSME exports and/or imports (e.g., the Kyrgyz Republic and Georgia), (ii) MSME output (e.g., Kazakhstan, Azerbaijan, Georgia, and the Kyrgyz Republic), and (iii) NBFIs loans (the Kyrgyz Republic). PC3 suggests that MSMEs felt the hard impacts from financial crises (GFC and RFC) with poor access to quality bank credit and NBFIs loans, more pronounced in Tajikistan. However, higher MSME foreign trade, output, and improved access to NBFIs loans likely encouraged MSME development, yet it remained very sensitive to shocks like the GFC, RFC, and the pandemic.



**Figure 4: Time Series Plots of Estimated Principal Components—  
Central and West Asia**



PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

**Table 9: Time Series Plots of Estimated Principal Components—  
Central and West Asia**

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
PC1	-0.22	-0.23	-0.24	-0.25	-0.29	-0.28	-0.27	-0.19	0.05	0.15	0.23	0.34	0.32	0.30	0.27	0.23
PC2	-0.27	-0.28	-0.19	-0.17	0.03	0.10	0.23	0.36	0.41	0.34	0.30	0.12	-0.06	-0.19	-0.28	-0.29
PC3	-0.33	-0.25	-0.35	0.24	0.40	0.35	0.25	0.04	-0.30	-0.32	0.03	0.15	0.18	0.03	0.21	0.07

PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

**Table 10: Contribution of Each Estimated Principal Component—  
Central and West Asia**

Item	PC1	PC2	PC3
Contribution ratio	0.63	0.15	0.08
Cumulative contribution rate	0.63	0.77	0.85

PC = principal component.

Source: Calculated based on ADB Asia SME Monitor 2023 database.

## 6. Policy Implications

The P-PCA estimates found three patterns of MSME development: (i) slow growth, (ii) fast growth, and (iii) quick growth but sensitive to shocks. The key factors affecting MSME development vary by the response to shocks and by region.

Based on all estimation results, the **slow MSME development** pattern (22%–63% explained, Figure 5A) found the key growth drivers to be (i) a sound market for bank credit, (ii) an environment favoring new business creation (number of MSMEs), and (iii) enhanced productivity (MSME output). However, these were unable to counter the major factors impeding MSME development—insufficient delivery or low quality of MSME lending. The result was slow MSME growth and development. Southeast Asia, South Asia, and Central and West Asia followed a similar structure, although the strongest growth drivers differed slightly by region. To avoid this slow growth scenario, policy support should focus more on developing sound MSME credit markets (e.g., through credit enhancement schemes such as credit guarantees and secured lending), increasing alternative financing options for MSMEs that go beyond traditional bank credit (i.e., nonbank and market-based finance), and promoting MSME internationalization.

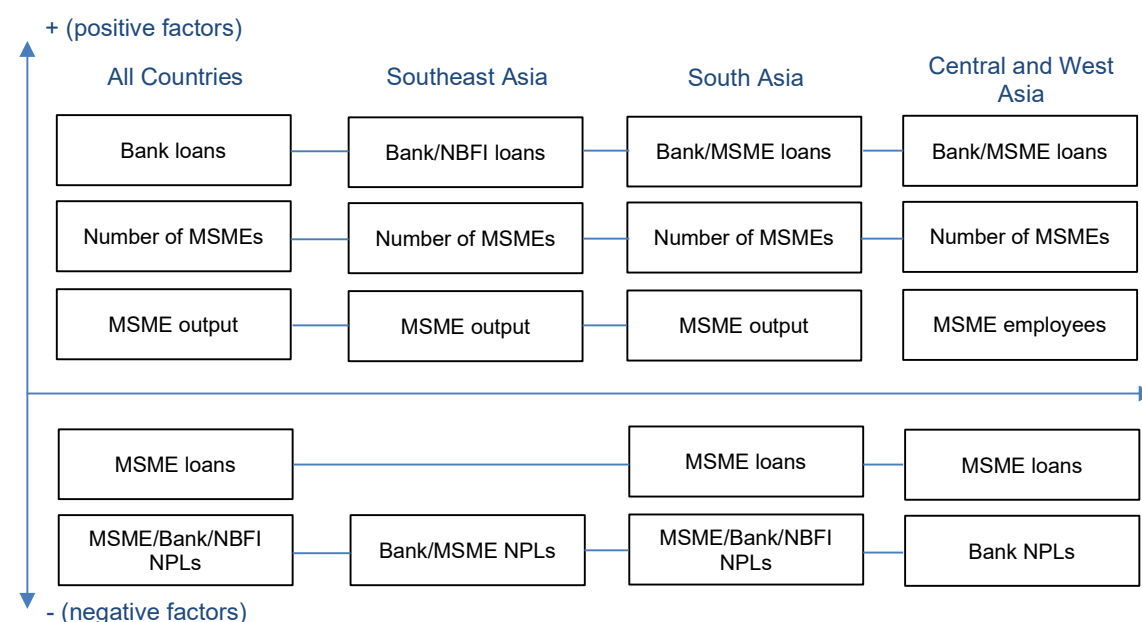
In the **fast MSME development** pattern (15%–59% explained, Figure 5B), the estimations for all countries and regions found the key growth drivers to be (i) job creation (MSME employees), (ii) enhanced productivity (MSME output), (iii) more and better quality MSME loans, and (iv) alternative financing options (market-based finance). These addressed negative factors such as low quality MSME loans. The more positive factors led to a relatively fast recovery from the GFC that supported MSME development. The availability of diverse financing options such as nonbank finance and capital markets likely helped. However, as a solid base of growth-oriented MSMEs does not exist nationally, they are likely sensitive to new shocks. Greater policy support in promoting MSME participation in foreign markets (exports or participation in global value chains) would boost development. This fast MSME growth pattern features strengthened capital markets as one of the growth drivers. In Southeast Asia, for example, there are several dedicated MSME equity markets—Thailand’s mai (market for alternative investment, since 1998); the Philippine SME Board (2001); Singapore’s Catalist (2007); Malaysia’s ACE (Access, Certainty, Efficiency) (2009) and LEAP (Leading Entrepreneur Accelerator Platform) (2017); and Indonesia’s Acceleration Board (2019). These markets provide growth capital to qualified MSMEs in those countries.

In the estimations for all countries and regions showing **MSME development sensitive to shocks** (7%–8% explained, Figure 5C), key growth drivers were (i) a generally sound bank credit market, (ii) capital market development, (iii) enhanced productivity (MSME output), and (iv) internationalization of MSMEs (exports/imports). The growth and development drivers largely unaddressed included alternative finance and MSME internationalization. The results showed a quick recovery from shocks, but one highly sensitive to new shocks—given its frequently changing trend curve. The negative factors estimated included a lack of—or low quality—MSME credit market. It suggests that the financial system remains weak and fragile against shocks in developing Asia and the Pacific.

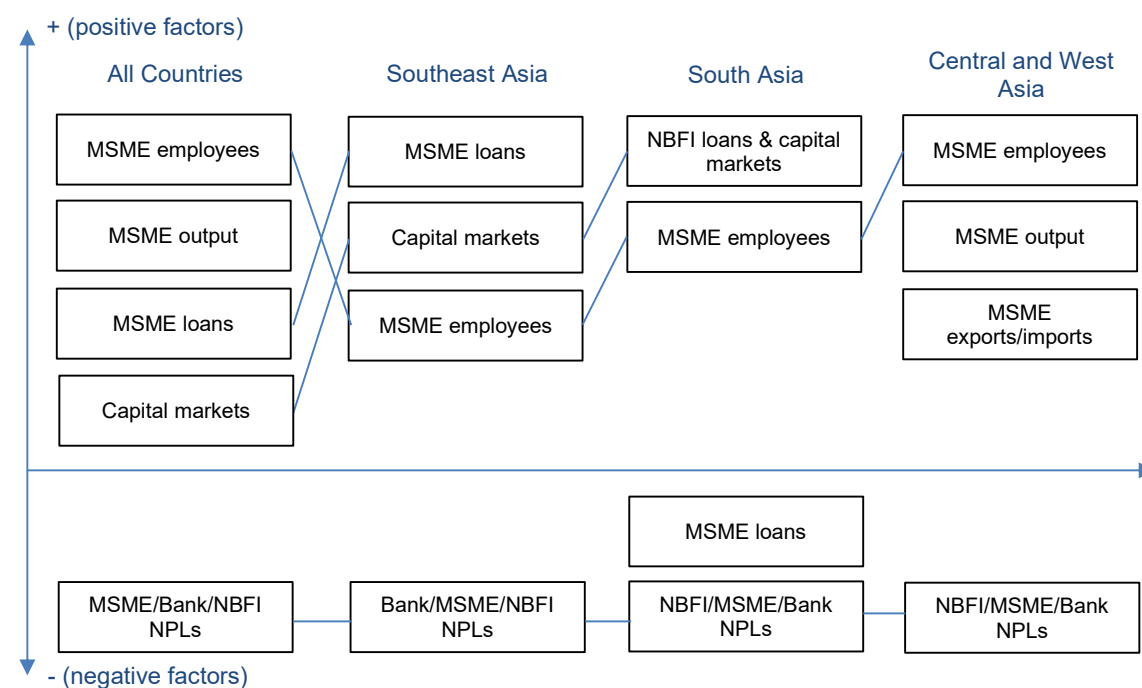
To sum up, the balanced development of sound MSME credit markets and expanding alternative financing options (nonbank finance and capital markets) would be critical to support sustainable MSME growth in developing Asia and the Pacific. These should be promoted and supported further within national financial inclusion strategies. Policy support for new business development (startups and entrepreneurship development), quality job creation (skilled labor training), and increasing MSME participation in global markets (promoting MSME exports/imports or

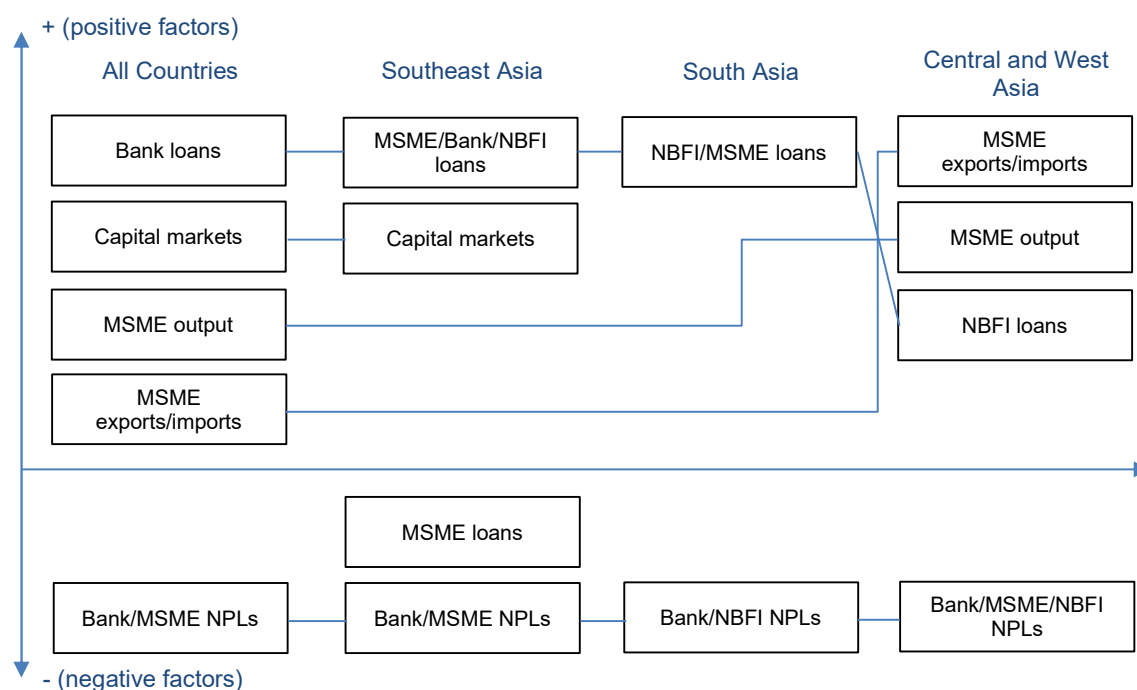
participation in global value chains) also plays a critical role. Together, they will help facilitate a smooth recovery of MSME growth and development from crises and shocks. And they will help create a solid base of growth oriented MSMEs nationally, contributing to resilient, inclusive growth across the region.

**Figure 5A: Slow MSME Development Path**



**Figure 5B: Fast MSME Development Path**



**Figure 5C: Sensitive MSME Development Path**

Source: Authors.

## 7. Conclusion

In a new trial for estimating factors affecting MSME development, we applied a variant of the PCA method—or P-PCA—by using time series MSME data from the ADB Asia SME Monitor 2023 database. The P-PCA estimated three factors that commonly explain various variables for MSME activities. Through these, we obtained three types of MSME development in developing Asia and the Pacific—slow growth, fast growth, and growth sensitive to shocks. They explain the different growth drivers and factors impeding MSME development, and the mismatches that may disrupt sustainable MSME growth.

The study found P-PCA useful where there are missing MSME data. However, continuous test-runs for various countries and strengthening datasets (especially business performance data) are crucial to improve the P-PCA model. Given that data limitation remains a critical concern, surveys should be designed to help fill missing information on MSMEs. As a next step, the use of granular firm-level data for the P-PCA should be examined to identify demand-side factors for business development. Once the validity of the P-PCA model is confirmed—as an analytical tool on MSME development—it could be used to forecast MSME development and help governments design more feasible, proactive, and evidence-based MSME policies. This is our future target.

## Appendix 1: MSME-Related Variables, 2007–2022

Table A1.1: Southeast Asia

Country	Variable	Unit	Obs	Mean	Median	S.D.	Min	Max
Brunei Darussalam	MSME output	\$ million	10	3,292	3,383	565	2,506	3,972
	Bank loans outstanding	\$ million	13	4,210	4,328	289	3,727	4,718
	Nonperforming bank loans	\$ million	13	228	218	54	161	341
	NBFI loans outstanding	\$ million	13	1,241	1,176	137	1,097	1,533
	Nonperforming NBFI loans	\$ million	13	13	13	4	6	19
Cambodia	Bank loans outstanding	\$ million	16	14,853	10,427	13,572	1,584	45,157
	Nonperforming bank loans	\$ million	16	358	220	349	55	1,396
	NBFI loans outstanding	\$ million	16	3,417	2,449	3,265	154	9,890
	Nonperforming NBFI loans	\$ million	16	58	18	78	0	254
	Market capitalization	\$ million	10	324	252	203	117	687
Indonesia	Number of MSMEs		10	59,001,245	58,579,247	4,418,366	52,764,750	65,465,497
	Number of employees		10	110,698,728	113,486,346	9,308,079	96,193,623	123,229,386
	MSME output	\$ million	10	482,190	449,210	110,994	330,258	689,214
	MSME exports	\$ million	10	18,456	19,186	3,615	13,481	24,400
	Bank loans outstanding	\$ million	12	335,731	337,748	58,820	242,622	408,338
	Nonperforming bank loans	\$ million	12	8,353	8,862	2,581	4,594	12,143
	MSME loans outstanding	\$ million	12	67,251	66,671	12,997	49,949	85,742
	Nonperforming MSME loans	\$ million	12	2,510	2,593	551	1,601	3,277
	Market capitalization	\$ million	16	403,428	423,522	138,691	98,310	603,848
Lao PDR	Bank loans outstanding	\$ million	16	5,021	5,455	3,044	406	8,436
	Nonperforming bank loans	\$ million	9	209	219	49	125	266
	MSME loans outstanding	\$ million	8	1,565	1,683	340	932	1,922
	NBFI loans outstanding	\$ million	13	276	179	264	6	686
	Market capitalization	\$ million	12	1,046	1,093	309	571	1,479
Malaysia	Number of MSMEs		9	1,074,391	1,151,339	187,220	638,790	1,226,494
	Number of employees		15	7,222,467	7,106,000	829,309	6,133,000	9,069,000
	MSME output	\$ million	15	107,410	110,035	18,369	77,910	135,312
	MSME exports	\$ million	12	38,279	41,065	5,143	29,377	44,020
	Bank loans outstanding	\$ million	16	352,497	367,883	86,771	194,634	458,655
	Nonperforming bank loans	\$ million	16	7,573	7,044	1,906	5,403	12,561
	MSME loans outstanding	\$ million	16	62,278	65,548	14,382	38,666	82,303
	Nonperforming MSME loans	\$ million	16	2,665	2,513	444	1,976	3,650
	NBFI loans outstanding	\$ million	16	392	350	153	180	749
	Market capitalization	\$ million	14	3,812	2,848	2,351	1,548	8,875
Myanmar	Number of MSMEs		13	47,962	40,396	13,741	38,590	75,116
	Bank loans outstanding	\$ million	11	62,118	11,845	101,770	3,368	314,562
	NBFI loans outstanding	\$ million	8	326	161	395	58	1,228
	Nonperforming NBFI loans	\$ million	8	2	1	4	0	10
Philippines	Number of MSMEs		16	911,709	929,002	106,438	758,436	1,105,143
	Number of employees		16	4,662,845	4,885,508	836,204	3,355,742	5,714,262
	Bank loans outstanding	\$ million	15	132,784	123,401	53,721	61,158	205,881
	Nonperforming bank loans	\$ million	15	3,972	3,022	2,207	2,415	8,912
	MSME loans outstanding	\$ million	15	9,019	9,325	1,776	5,563	11,605
	Nonperforming MSME loans	\$ million	13	656	574	179	521	1,037
	NBFI loans outstanding	\$ million	13	5,704	6,582	5,291	135	12,998
	Market capitalization	\$ million	16	322	221	349	7	1,216
Singapore	Number of MSMEs		9	266,356	262,800	20,475	242,900	298,500
	Number of employees		9	2,467,778	2,470,000	62,805	2,360,000	2,590,000
	MSME output	\$ million	9	156,700	152,593	26,133	129,286	211,215
	Bank loans outstanding	\$ million	13	847,714	870,379	160,722	496,942	1,025,553
	Nonperforming bank loans	\$ million	14	12,890	11,698	7,741	-	26,357
	MSME loans outstanding	\$ million	13	60,861	56,205	18,347	35,987	101,108
	Nonperforming MSME loans	\$ million	13	1,788	1,607	1,259	441	3,617
	NBFI loans outstanding	\$ million	13	9,374	9,398	1,393	6,247	11,237
	Market capitalization	\$ million	15	6,537	6,890	1,992	2,474	9,567
Thailand	Number of MSMEs		16	2,898,833	2,904,637	226,194	2,366,227	3,187,378
	Number of employees		15	11,569,702	11,747,093	1,367,048	8,900,567	13,950,241
	MSME output	\$ million	16	141,978	131,488	29,202	103,128	196,381
	MSME exports	\$ million	16	38,068	30,908	14,333	22,258	67,433
	MSME imports	\$ million	16	43,567	37,855	16,399	29,799	84,502
	Bank loans outstanding	\$ million	16	517,849	507,787	165,642	237,067	758,489
	Nonperforming bank loans	\$ million	14	11,802	11,026	3,227	8,097	17,706
	MSME loans outstanding	\$ million	16	148,950	155,560	42,169	77,586	218,289
	Nonperforming MSME loans	\$ million	14	5,851	5,629	1,539	4,079	8,222
	Market capitalization	\$ million	16	6,986	7,279	4,830	635	15,490
Viet Nam	Number of MSMEs		15	422,093	393,915	179,963	143,622	699,859
	Number of employees		15	4,968,626	5,321,882	944,386	2,834,950	6,205,320
	Bank loans outstanding	\$ million	9	256,219	248,450	84,589	148,401	383,940
	Nonperforming bank loans	\$ million	8	5,872	5,959	233	5,424	6,084
	NBFI loans outstanding	\$ million	11	2,763	2,827	1,037	1,252	4,212
	Nonperforming NBFI loans	\$ million	10	6	0	12	0	31
	Market capitalization	\$ million	14	19,776	8,239	21,478	237	61,286

Lao PDR = Lao People's Democratic Republic; MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution; obs = observations; S.D. = standard deviation.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

**Table A1.2: South Asia**

Country	Variable	Unit	Obs	Mean	Median	S.D.	Min	Max
Bangladesh	MSME output	\$ million	9	3,942	3,927	795	2,826	5,230
	Bank loans outstanding	\$ million	13	92,427	88,779	38,578	43,935	151,724
	Nonperforming bank loans	\$ million	13	11,163	7,891	11,347	2,767	46,951
	MSME loans outstanding	\$ million	13	19,485	21,024	6,576	9,478	28,066
	NBFI loans outstanding	\$ million	11	6,508	7,115	1,594	3,364	7,912
	Nonperforming NBFI loans	\$ million	11	729	547	519	174	1,699
	Market capitalization	\$ million	16	36,419	37,965	13,967	6,939	59,940
India	Number of MSMEs		11	45,758,425	44,764,000	7,799,256	36,176,000	63,387,673
	Number of employees		11	99,962,545	101,169,000	12,467,165	80,523,000	117,132,000
	MSME output	\$ million	12	524,532	525,836	57,853	445,618	615,535
	MSME exports	\$ million	8	141,178	137,975	11,433	127,986	159,189
	Bank loans outstanding	\$ million	16	1,051,381	1,026,220	337,711	540,122	1,540,214
	Nonperforming bank loans	\$ million	16	68,102	56,813	46,769	12,722	132,150
	MSME loans outstanding	\$ million	8	225,942	235,876	28,126	182,149	255,880
	Nonperforming MSME loans	\$ million	8	21,087	21,955	2,797	17,433	24,512
	NBFI loans outstanding	\$ million	8	258,910	291,440	107,343	38,953	382,720
	Nonperforming NBFI loans	\$ million	8	15,079	15,447	8,708	2,241	27,983
	Market capitalization	\$ million	10	2,403	2,621	1,785	52	6,402
Nepal	Number of MSMEs		10	248,979	235,538	75,819	156,343	390,493
	Number of employees		12	2,195,870	2,149,225	315,984	1,761,863	2,808,052
	Bank loans outstanding	\$ million	16	15,690	12,011	10,606	-	35,691
	Market capitalization	\$ million	15	12,118	10,607	8,135	3,783	33,042
Pakistan	MSME output	\$ million	16	3,783	4,045	1,497	1,524	5,883
	Bank loans outstanding	\$ million	16	49,848	48,494	8,039	40,363	62,093
	Nonperforming bank loans	\$ million	16	4,929	4,908	919	2,964	6,364
	MSME loans outstanding	\$ million	16	3,566	3,176	1,076	2,387	6,725
	Nonperforming MSME loans	\$ million	16	721	686	230	349	1,133
	NBFI loans outstanding	\$ million	16	577	560	158	367	820
	Nonperforming NBFI loans	\$ million	16	26	26	9	14	41
	Market capitalization	\$ million	16	52,238	50,396	19,593	23,498	91,866
Sri Lanka	Bank loans outstanding	\$ million	16	30,910	30,471	12,670	13,739	52,285
	Nonperforming bank loans	\$ million	16	1,435	1,077	761	714	3,476
	NBFI loans outstanding	\$ million	16	4,490	4,562	2,119	977	7,253
	Nonperforming NBFI loans	\$ million	14	410	345	240	53	867
	Market capitalization	\$ million	16	16,447	17,687	5,968	4,320	27,386

MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution; obs = observations; S.D. = standard deviation.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

Table A1.3: Central and West Asia

Country	Variable	Unit	Obs	Mean	Median	S.D.	Min	Max
Armenia	Number of MSMEs		15	81,523	76,589	21,862	59,267	132,923
	Number of employees		14	306,576	269,773	99,645	168,185	471,394
	MSME output	\$ million	15	3,707	3,562	571	2,833	4,851
	Bank loans outstanding	\$ million	16	4,723	4,280	2,415	1,344	9,916
	Nonperforming bank loans	\$ million	16	153	158	104	15	360
	NBFI loans outstanding	\$ million	16	389	368	191	126	725
	Market capitalization	\$ million	16	240	195	141	105	679
Azerbaijan	Number of MSMEs		15	212,011	196,972	61,548	135,353	355,906
	Number of employees		15	198,780	115,035	111,155	90,182	357,840
	MSME output	\$ million	15	3,229	2,395	2,358	531	8,209
	Bank loans outstanding	\$ million	16	11,105	9,937	4,532	5,389	22,790
	Nonperforming bank loans	\$ million	16	697	777	322	119	1,245
	NBFI loans outstanding	\$ million	11	312	225	184	148	687
Georgia	Number of MSMEs		15	81,549	70,491	39,754	32,961	139,275
	Number of employees		15	381,627	405,637	93,643	226,064	491,668
	MSME output	\$ million	15	3,417	3,744	1,232	1,400	4,814
	MSME exports	\$ million	8	1,814	1,774	467	1,311	2,703
	MSME imports	\$ million	8	4,930	4,821	1,001	3,801	7,011
	Bank loans outstanding	\$ million	16	7,545	6,754	4,118	2,830	16,575
	Nonperforming bank loans	\$ million	16	523	509	184	76	977
	MSME loans outstanding	\$ million	8	2,724	2,310	1,671	1,508	6,735
	Nonperforming MSME loans	\$ million	13	127	82	83	54	297
	NBFI loans outstanding	\$ million	16	400	427	269	35	1,061
	Market capitalization	\$ million	11	861	764	243	553	1,283
Kazakhstan	Number of MSMEs		16	1,051,333	1,016,599	338,534	643,376	1,818,764
	Number of employees		16	2,924,749	2,988,877	581,227	2,121,198	4,109,741
	MSME output	\$ million	16	41,463	38,440	18,161	11,393	81,284
	Bank loans outstanding	\$ million	16	50,063	50,388	13,103	34,075	73,293
	Nonperforming bank loans	\$ million	15	10	4	9	2	27
	MSME loans outstanding	\$ million	16	8,911	9,025	2,236	5,512	13,003
Kyrgyz Republic	NBFI loans outstanding	\$ million	16	1,690	326	2,086	121	5,825
	Number of MSMEs		15	13,720	13,505	2,171	9,852	17,050
	Number of employees		15	91,773	89,400	5,928	86,000	107,800
	MSME output	\$ million	15	2,692	2,695	641	1,702	3,811
	MSME exports	\$ million	15	585	578	123	386	773
	MSME imports	\$ million	15	2,645	2,837	634	1,139	3,398
	Bank loans outstanding	\$ million	16	1,307	1,288	632	560	2,381
	Nonperforming bank loans	\$ million	15	74	65	50	18	205
	MSME loans outstanding	\$ million	15	982	1,000	452	456	1,648
	NBFI loans outstanding	\$ million	16	248	236	76	139	381
	Market capitalization	\$ million	16	277	174	228	72	941
Tajikistan	Number of MSMEs		15	34,382	31,144	10,025	24,459	55,750
	Number of employees		14	232,316	231,273	38,669	187,000	302,000
	MSME output	\$ million	14	4,096	4,498	1,044	2,242	5,336
	Bank loans outstanding	\$ million	15	990	914	249	701	1,463
	Nonperforming bank loans	\$ million	12	244	237	152	52	557
	MSME loans outstanding	\$ million	11	182	144	74	101	329
	Nonperforming MSME loans	\$ million	11	37	33	24	6	86
	NBFI loans outstanding	\$ million	15	288	219	164	99	647
Uzbekistan	Nonperforming NBFI loans	\$ million	15	9	7	7	1	27
	Number of MSMEs		16	247,815	201,559	120,778	129,211	523,556
	Number of employees		16	9,518,725	9,908,250	898,698	7,743,100	10,541,500
	MSME output	\$ million	16	30,280	30,455	11,562	8,974	48,168
	MSME exports	\$ million	16	2,925	3,120	1,026	1,334	4,715
	MSME imports	\$ million	16	7,187	5,793	4,003	2,155	14,972
	Bank loans outstanding	\$ million	8	19,523	18,176	6,338	13,276	30,116
	Nonperforming bank loans	\$ million	8	435	268	476	121	1,566
	NBFI loans outstanding	\$ million	8	60	46	34	24	123
	Nonperforming NBFI loans	\$ million	8	6	3	6	1	18
	Market capitalization	\$ million	13	3,735	2,897	1,831	1,825	8,408

MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution; obs = observations; S.D. = standard deviation.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

**Table A1.4: Pacific**

Country	Variable	Unit	Obs	Mean	Median	S.D.	Min	Max
Fiji	Bank loans outstanding	\$ million	16	2,571	2,641	783	1,566	3,568
	Nonperforming bank loans	\$ million	16	109	99	69	28	282
	MSME loans outstanding	\$ million	16	216	190	138	35	415
	Market capitalization	\$ million	16	854	545	537	405	1,921
Papua New Guinea	Bank loans outstanding	\$ million	14	4,535	5,420	2,170	494	6,273
	Nonperforming bank loans	\$ million	14	166	160	123	0	365
	MSME loans outstanding	\$ million	8	1,195	1,034	410	928	2,170
	NBFI loans outstanding	\$ million	11	509	511	46	430	586
	Nonperforming NBFI loans	\$ million	11	56	51	18	23	83
	Market capitalization	\$ million	7	25,573	23,541	12,499	10,981	41,408
Samoa	Number of MSMEs		11	4,472	4,614	585	3,277	5,218
	Bank loans outstanding	\$ million	16	374	362	71	246	465
	Nonperforming bank loans	\$ million	16	19	18	3	15	25
	MSME loans outstanding	\$ million	11	128	123	42	63	200

MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution; obs = observations; S.D. = standard deviation.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.



## Appendix 2: Missing Data, 2007–2022

Table A2.1: Southeast Asia

Country	Variable	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Brunei Darussalam	MSME output	n/a.,	n/a.,	n/a.,					n/a.,							n/a.,	n/a.,
	Bank loans outstanding	n/a.,	n/a.,	n/a.,													
	Nonperforming bank loans	n/a.,	n/a.,	n/a.,													
	NBFI loans outstanding	n/a.,	n/a.,	n/a.,													
	Nonperforming NBFI loans	n/a.,	n/a.,	n/a.,													
Cambodia	Bank loans outstanding																
	Nonperforming bank loans																
	NBFI loans outstanding																
	Nonperforming NBFI loans																
	Market capitalization	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,											n/a.,
Indonesia	Number of MSMEs	n/a.,	n/a.,	n/a.,											n/a.,	n/a.,	n/a.,
	Number of employees	n/a.,	n/a.,	n/a.,											n/a.,	n/a.,	n/a.,
	MSME output	n/a.,	n/a.,	n/a.,											n/a.,	n/a.,	n/a.,
	MSME exports	n/a.,	n/a.,	n/a.,											n/a.,	n/a.,	n/a.,
	Bank loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,												
	Nonperforming bank loans	n/a.,	n/a.,	n/a.,	n/a.,												
	MSME loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,												
	Nonperforming MSME loans	n/a.,	n/a.,	n/a.,	n/a.,												
	Market capitalization																
Lao PDR	Bank loans outstanding																
	Nonperforming bank loans	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,									
	MSME loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								
	NBFI loans outstanding	n/a.,	n/a.,	n/a.,													
	Market capitalization	n/a.,	n/a.,	n/a.,	n/a.,												
Malaysia	Number of MSMEs	n/a.,	n/a.,	n/a.,		n/a.,	n/a.,	n/a.,	n/a.,								
	Number of employees																n/a.,
	MSME output																n/a.,
	MSME exports	n/a.,	n/a.,	n/a.,													n/a.,
	Bank loans outstanding																
	Nonperforming bank loans																
	MSME loans outstanding																
	Nonperforming MSME loans																
	NBFI loans outstanding																
	Market capitalization	n/a.,	n/a.,														
Myanmar	Number of MSMEs														n/a.,	n/a.,	n/a.,
	Bank loans outstanding	n/a.,	n/a.,												n/a.,	n/a.,	n/a.,
	NBFI loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								n/a.,	n/a.,	n/a.,
	Nonperforming NBFI loans	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,									n/a.,	n/a.,	n/a.,
Philippines	Number of MSMEs																
	Number of employees																
	Bank loans outstanding	n/a.,															
	Nonperforming bank loans	n/a.,															
	MSME loans outstanding	n/a.,															
	Nonperforming MSME loans	n/a.,	n/a.,	n/a.,													
	NBFI loans outstanding	n/a.,	n/a.,														n/a.,
	Market capitalization																
Singapore	Number of MSMEs	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,									
	Number of employees	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								
	MSME output	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								
	Bank loans outstanding	n/a.,	n/a.,	n/a.,													
	Nonperforming bank loans	n/a.,	n/a.,	n/a.,													
	MSME loans outstanding	n/a.,	n/a.,	n/a.,													
	Nonperforming MSME loans	n/a.,	n/a.,	n/a.,													
	NBFI loans outstanding	n/a.,	n/a.,	n/a.,													
	Market capitalization	n/a.,															
Thailand	Number of MSMEs																
	Number of employees																
	MSME output																
	MSME exports																
	MSME imports																
	Bank loans outstanding																
	Nonperforming bank loans	n/a.,	n/a.,														
	MSME loans outstanding																
	Nonperforming MSME loans	n/a.,	n/a.,														
	Market capitalization																
Viet Nam	Number of MSMEs																n/a.,
	Number of employees																n/a.,
	Bank loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,									n/a.,	n/a.,	
	Nonperforming bank loans	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,					n/a.,				n/a.,	n/a.,	
	NBFI loans outstanding	n/a.,	n/a.,	n/a.,											n/a.,	n/a.,	
	Nonperforming NBFI loans	n/a.,	n/a.,	n/a.,	n/a.,										n/a.,	n/a.,	
	Market capitalization	n/a.,	n/a.,														

Lao PDR = Lao People's Democratic Republic; MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution; n/a., = not available.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

Table A2.2: South Asia

Country	Variable	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bangladesh	MSME output	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,										n/a.,	n/a.,
	Bank loans outstanding	n/a.,	n/a.,	n/a.,													
	Nonperforming bank loans	n/a.,	n/a.,	n/a.,													
	MSME loans outstanding	n/a.,	n/a.,	n/a.,													
	NBFI loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,											
	Nonperforming NBFI loans	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,											
	Market capitalization																
India	Number of MSMEs	n/a.,												n/a.,	n/a.,	n/a.,	n/a.,
	Number of employees	n/a.,												n/a.,	n/a.,	n/a.,	n/a.,
	MSME output	n/a.,													n/a.,	n/a.,	n/a.,
	MSME exports	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,									n/a.,	n/a.,
	Bank loans outstanding																
	Nonperforming bank loans																
	MSME loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								
	Nonperforming MSME loans	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								
	NBFI loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								
	Nonperforming NBFI loans	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								
	Market capitalization	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,											n/a.,
Nepal	Number of MSMEs	n/a.,	n/a.,	n/a.,											n/a.,	n/a.,	n/a.,
	Number of employees	n/a.,													n/a.,	n/a.,	n/a.,
	Bank loans outstanding	n/a.,															
	Market capitalization	n/a.,															
Pakistan	MSME output																
	Bank loans outstanding																
	Nonperforming bank loans																
	MSME loans outstanding																
	Nonperforming MSME loans																
	NBFI loans outstanding																
	Nonperforming NBFI loans																
	Market capitalization																
Sri Lanka	Bank loans outstanding																
	Nonperforming bank loans																
	NBFI loans outstanding																
	Nonperforming NBFI loans	n/a.,	n/a.,														
	Market capitalization																

MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution; n/a., = not available.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

Table A2.3: Central and West Asia

Country	Variable	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Armenia	Number of MSMEs																n/a.,
	Number of employees							n/a.,									n/a.,
	MSME output																n/a.,
	Bank loans outstanding																
	Nonperforming bank loans																
	NBFI loans outstanding																
	Market capitalization																
Azerbaijan	Number of MSMEs																n/a.,
	Number of employees																n/a.,
	MSME output																n/a.,
	Bank loans outstanding																
	Nonperforming bank loans																
	NBFI loans outstanding		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,										
	Market capitalization																
Georgia	Number of MSMEs																n/a.,
	Number of employees																n/a.,
	MSME output																n/a.,
	MSME exports		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,							
	MSME imports		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,							
	Bank loans outstanding																
	Nonperforming bank loans																
	MSME loans outstanding		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,							
	Nonperforming MSME loans		n/a.,	n/a.,	n/a.,												
	NBFI loans outstanding																
	Market capitalization		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,										
Kazakhstan	Number of MSMEs																
	Number of employees																
	MSME output																
	Bank loans outstanding																
	Nonperforming bank loans		n/a.,														
	MSME loans outstanding																
	NBFI loans outstanding																
Kyrgyz Republic	Number of MSMEs																n/a.,
	Number of employees																n/a.,
	MSME output																n/a.,
	MSME exports																n/a.,
	MSME imports																n/a.,
	Bank loans outstanding																
	Nonperforming bank loans		n/a.,														
	MSME loans outstanding																n/a.,
	NBFI loans outstanding																
	Market capitalization																
Tajikistan	Number of MSMEs		n/a.,														
	Number of employees											n/a.,					n/a.,
	MSME output		n/a.,														n/a.,
	Bank loans outstanding																n/a.,
	Nonperforming bank loans		n/a.,	n/a.,	n/a.,												n/a.,
	MSME loans outstanding		n/a.,	n/a.,	n/a.,	n/a.,											n/a.,
	Nonperforming MSME loans		n/a.,	n/a.,	n/a.,	n/a.,											n/a.,
	NBFI loans outstanding																n/a.,
	Nonperforming NBFI loans																n/a.,
Uzbekistan	Number of MSMEs																
	Number of employees																
	MSME output																
	MSME exports																
	MSME imports																
	Bank loans outstanding		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								n/a.,
	Nonperforming bank loans		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								n/a.,
	NBFI loans outstanding		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								n/a.,
	Nonperforming NBFI loans		n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,								n/a.,
	Market capitalization		n/a.,	n/a.,	n/a.,												

MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution; n/a., = not available.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

Table A2.4: Pacific

Country	Variable	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Fiji	Bank loans outstanding																
	Nonperforming bank loans																
	MSME loans outstanding																
	Market capitalization																
Papua New Guinea	Bank loans outstanding	n/a.,	n/a.,														
	Nonperforming bank loans	n/a.,	n/a.,														
	MSME loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,							
	NBFI loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,											
	Nonperforming NBFI loans	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,											
	Market capitalization									n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,
Samoa	Number of MSMEs	n/a.,	n/a.,	n/a.,	n/a.,	n/a.,											
	Bank loans outstanding																
	Nonperforming bank loans																
	MSME loans outstanding	n/a.,	n/a.,	n/a.,	n/a.,												n/a.,

MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution; n/a., = not available.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

## Appendix 3: Factor Loadings Based on Probabilistic Principal Component Analysis

Table A3.1: All Countries

Country	Variable	PC1	Country	Variable	PC2	Country	Variable	PC3
Philippines	Bank loans outstanding	0.98	Tajikistan	MSME output	0.88	Malaysia	Bank loans outstanding	0.76
Indonesia	Number of MSMEs	0.97	India	Number of employees	0.87	Indonesia	Market capitalization	0.72
Nepal	Number of MSMEs	0.96	Uzbekistan	Number of employees	0.86	Malaysia	MSME output	0.68
Indonesia	MSME output	0.92	Azerbaijan	Nonperforming bank loans	0.85	Papua New Guinea	Market capitalization	0.66
Fiji	Bank loans outstanding	0.92	Viet Nam	Number of employees	0.82	Kazakhstan	MSME output	0.63
Philippines	NBFI loans outstanding	0.92	Lao PDR	Market capitalization	0.80	Thailand	Bank loans outstanding	0.57
Kyrgyz Republic	Bank loans outstanding	0.91	Lao PDR	MSME loans outstanding	0.76	Bangladesh	Market capitalization	0.57
Georgia	Number of MSMEs	0.88	Philippines	MSME loans outstanding	0.76	Azerbaijan	MSME output	0.53
Kyrgyz Republic	MSME loans outstanding	0.87	Sri Lanka	NBFI loans outstanding	0.76	Indonesia	MSME exports	0.50
Cambodia	NBFI loans outstanding	0.87	Thailand	MSME loans outstanding	0.75	Kyrgyz Republic	NBFI loans outstanding	0.50
Viet Nam	Number of MSMEs	0.86	Pakistan	Market capitalization	0.73	Armenia	Bank loans outstanding	0.49
India	Bank loans outstanding	0.84	Georgia	Number of employees	0.72	Georgia	MSME output	0.48
Viet Nam	NBFI loans outstanding	0.84	Tajikistan	Number of employees	0.70	Philippines	Number of MSMEs	0.47
Kyrgyz Republic	Number of MSMEs	0.82	Uzbekistan	MSME output	0.70	Kyrgyz Republic	MSME output	0.44
India	Nonperforming bank loans	0.82	Tajikistan	Nonperforming NBFI loans	0.70	India	Bank loans outstanding	0.44
Nepal	Number of employees	0.79	Georgia	MSME output	0.68	Thailand	Number of employees	0.39
Azerbaijan	Number of employees	0.79	Papua New Guinea	Bank loans outstanding	0.67	Kyrgyz Republic	MSME imports	0.39
Lao PDR	Bank loans outstanding	0.79	Malaysia	MSME loans outstanding	0.67	Armenia	NBFI loans outstanding	0.39
Pakistan	MSME output	0.78	Singapore	Market capitalization	0.67	Myanmar	Nonperforming NBFI loans	0.39
Nepal	Bank loans outstanding	0.78	Tajikistan	Nonperforming bank loans	0.65	Viet Nam	Nonperforming bank loans	0.38
Viet Nam	Bank loans outstanding	0.77	Malaysia	Number of employees	0.64	Samoa	Bank loans outstanding	0.37
Pakistan	Bank loans outstanding	0.77	Indonesia	Number of employees	0.60	Sri Lanka	Market capitalization	0.35
Sri Lanka	Bank loans outstanding	0.77	Tajikistan	Nonperforming MSME loans	0.59	Myanmar	NBFI loans outstanding	0.34
Georgia	Bank loans outstanding	0.77	Thailand	Market capitalization	0.57	Philippines	Number of employees	0.33
Fiji	MSME loans outstanding	0.77	Philippines	Number of employees	0.56	Nepal	Bank loans outstanding	0.33
Kazakhstan	Number of employees	0.76	Lao PDR	Bank loans outstanding	0.56	Uzbekistan	Number of MSMEs	0.32
Bangladesh	MSME output	0.74	Uzbekistan	MSME exports	0.54	Kyrgyz Republic	Nonperforming bank loans	0.32
Sri Lanka	Nonperforming NBFI loans	0.74	Sri Lanka	Market capitalization	0.54	Viet Nam	Number of MSMEs	0.31
Myanmar	Number of MSMEs	0.72	Brunei Darussalam	Nonperforming NBFI loans	0.52	Georgia	Bank loans outstanding	0.31
Thailand	Bank loans outstanding	0.72	Brunei Darussalam	NBFI loans outstanding	0.48	Malaysia	MSME loans outstanding	0.31
Armenia	Bank loans outstanding	0.72	Azerbaijan	Bank loans outstanding	0.45	Pakistan	Nonperforming bank loans	0.30
Papua New Guinea	Nonperforming bank loans	0.71	Pakistan	MSME output	0.44	Nepal	Number of employees	0.29
Bangladesh	MSME loans outstanding	0.71	India	Number of MSMEs	0.43	Georgia	MSME imports	0.29
Kazakhstan	Number of MSMEs	0.69	Pakistan	Nonperforming bank loans	0.43	Papua New Guinea	NBFI loans outstanding	0.29
Samoa	Bank loans outstanding	0.69	Tajikistan	Bank loans outstanding	0.41	Thailand	MSME loans outstanding	0.28
Cambodia	Bank loans outstanding	0.68	Kyrgyz Republic	MSME imports	0.39	Viet Nam	Number of employees	0.27
Armenia	NBFI loans outstanding	0.68	Bangladesh	Market capitalization	0.38	Uzbekistan	MSME imports	0.27
Myanmar	Nonperforming NBFI loans	0.68	Malaysia	Bank loans outstanding	0.37	Sri Lanka	Nonperforming bank loans	0.27
Viet Nam	Market capitalization	0.68	Sri Lanka	Bank loans outstanding	0.35	Thailand	MSME imports	0.25
Bangladesh	Bank loans outstanding	0.65	Georgia	NBFI loans outstanding	0.35	Kyrgyz Republic	Market capitalization	0.25
Uzbekistan	MSME imports	0.64	Armenia	Nonperforming bank loans	0.34	Indonesia	MSME output	0.24
Myanmar	NBFI loans outstanding	0.64	Azerbaijan	NBFI loans outstanding	0.34	India	MSME output	0.24
Kazakhstan	NBFI loans outstanding	0.64	Samoa	Bank loans outstanding	0.32	Georgia	MSME exports	0.24
Armenia	Nonperforming bank loans	0.63	Malaysia	MSME output	0.31	Uzbekistan	MSME exports	0.24
India	Number of MSMEs	0.62	Fiji	Bank loans outstanding	0.31	Philippines	MSME loans outstanding	0.24
Thailand	MSME output	0.62	Fiji	MSME loans outstanding	0.31	Viet Nam	Nonperforming NBFI loans	0.24
Singapore	Nonperforming MSME loans	0.62	Philippines	Number of MSMEs	0.30	Malaysia	MSME exports	0.23
Fiji	Market capitalization	0.62	Samoa	Nonperforming bank loans	0.30	Kyrgyz Republic	MSME exports	0.23
Lao PDR	NBFI loans outstanding	0.61	Nepal	Number of employees	0.29	Georgia	NBFI loans outstanding	0.23
Singapore	Bank loans outstanding	0.60	India	Nonperforming bank loans	0.28	Kazakhstan	Nonperforming bank loans	0.22
Brunei Darussalam	MSME output	0.57	Tajikistan	MSME loans outstanding	0.27	Cambodia	Bank loans outstanding	0.20
Georgia	Number of employees	0.55	Malaysia	MSME exports	0.26	Azerbaijan	Nonperforming bank loans	0.19
Indonesia	Bank loans outstanding	0.55	Kyrgyz Republic	MSME loans outstanding	0.24	India	MSME loans outstanding	0.19
Thailand	Nonperforming MSME loans	0.55	Pakistan	NBFI loans outstanding	0.24	Georgia	MSME loans outstanding	0.19
Pakistan	NBFI loans outstanding	0.55	Indonesia	Market capitalization	0.24	Nepal	Number of MSMEs	0.18
Bangladesh	NBFI loans outstanding	0.54	Thailand	Bank loans outstanding	0.22	Georgia	Number of employees	0.18
Kyrgyz Republic	MSME output	0.51	Viet Nam	NBFI loans outstanding	0.22	India	Number of MSMEs	0.17
Philippines	Number of employees	0.49	Georgia	Market capitalization	0.22	Thailand	MSME output	0.17
Indonesia	Nonperforming bank loans	0.49	Indonesia	Number of MSMEs	0.21	Uzbekistan	MSME output	0.17
Thailand	Number of MSMEs	0.48	Philippines	Market capitalization	0.21	Uzbekistan	Nonperforming bank loans	0.16
Papua New Guinea	Bank loans outstanding	0.48	Georgia	Number of MSMEs	0.20	Tajikistan	MSME output	0.15
Sri Lanka	NBFI loans outstanding	0.48	Viet Nam	Number of MSMEs	0.18	Cambodia	Nonperforming bank loans	0.15
Nepal	Market capitalization	0.47	Singapore	Number of employees	0.18	Singapore	Market capitalization	0.15
Indonesia	Number of employees	0.47	Thailand	Number of employees	0.18	India	MSME exports	0.14
Thailand	Nonperforming bank loans	0.46	Kazakhstan	Nonperforming bank loans	0.17	Azerbaijan	Bank loans outstanding	0.14
Malaysia	MSME loans outstanding	0.46	Pakistan	Bank loans outstanding	0.16	Kyrgyz Republic	Number of MSMEs	0.13
Indonesia	Nonperforming MSME loans	0.45	Kazakhstan	Number of employees	0.15	Fiji	Nonperforming bank loans	0.13
Indonesia	MSME exports	0.44	Singapore	Bank loans outstanding	0.15	Papua New Guinea	MSME loans outstanding	0.11
Thailand	Number of employees	0.43	Kyrgyz Republic	MSME output	0.12	Pakistan	MSME output	0.10
Indonesia	MSME loans outstanding	0.43	Azerbaijan	Number of employees	0.11	Thailand	MSME exports	0.10
Uzbekistan	Number of MSMEs	0.42	India	Bank loans outstanding	0.11	Myanmar	Bank loans outstanding	0.10
Samoa	Number of MSMEs	0.42	Pakistan	Nonperforming MSME loans	0.11	Cambodia	NBFI loans outstanding	0.10
Azerbaijan	MSME output	0.42	Kyrgyz Republic	NBFI loans outstanding	0.10	Kyrgyz Republic	Bank loans outstanding	0.10
Uzbekistan	Number of employees	0.40	Kazakhstan	Number of MSMEs	0.08	Singapore	MSME output	0.10
Philippines	MSME loans outstanding	0.40	Singapore	NBFI loans outstanding	0.08	Uzbekistan	Number of employees	0.09
Cambodia	Nonperforming NBFI loans	0.40	Kyrgyz Republic	Bank loans outstanding	0.05	Philippines	Nonperforming bank loans	0.09
Samoa	MSME loans outstanding	0.39	Nepal	Number of MSMEs	0.04	Brunei Darussalam	Nonperforming bank loans	0.09
Cambodia	Market capitalization	0.39	Kazakhstan	Bank loans outstanding	0.03	Kyrgyz Republic	MSME loans outstanding	0.08
Malaysia	MSME output	0.38	Bangladesh	Nonperforming bank loans	0.03	Kazakhstan	Number of MSMEs	0.08
India	MSME exports	0.38	Singapore	Nonperforming bank loans	0.02	Sri Lanka	Bank loans outstanding	0.08
Malaysia	Bank loans outstanding	0.37	Brunei Darussalam	MSME output	0.02	Georgia	Nonperforming bank loans	0.08
Cambodia	Nonperforming bank loans	0.36	Indonesia	MSME output	0.02	Brunei Darussalam	Bank loans outstanding	0.08
Singapore	NBFI loans outstanding	0.36	Armenia	NBFI loans outstanding	0.00	Pakistan	Nonperforming NBFI loans	0.08
Georgia	MSME output	0.35	Samoa	Number of MSMEs	-0.01	Kazakhstan	Number of employees	0.08
Singapore	Market capitalization	0.35	Tajikistan	Number of MSMEs	-0.03	Azerbaijan	NBFI loans outstanding	0.07
Armenia	Market capitalization	0.35	Kyrgyz Republic	Number of MSMEs	-0.03	Cambodia	Nonperforming NBFI loans	0.07
India	Number of employees	0.34	Kazakhstan	MSME output	-0.04	Georgia	Market capitalization	0.07
Indonesia	Market capitalization	0.34	Brunei Darussalam	Nonperforming bank loans	-0.05	Tajikistan	MSME loans outstanding	0.07
Philippines	Number of MSMEs	0.33	Armenia	Number of employees	-0.07	Georgia	Number of MSMEs	0.07
Azerbaijan	Number of MSMEs	0.32	India	NBFI loans outstanding	-0.08	Philippines	Bank loans outstanding	0.07
Malaysia	Number of MSMEs	0.31	Philippines	Bank loans outstanding	-0.09	Pakistan	Nonperforming MSME loans	0.06
Thailand	MSME loans outstanding	0.31	Armenia	Bank loans outstanding	-0.12	Kazakhstan	NBFI loans outstanding	0.06

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Country	Variable	PC1	Country	Variable	PC2	Country	Variable	PC3
Georgia	NBFI loans outstanding	0.31	Kyrgyz Republic	MSME exports	-0.13	Malaysia	Number of employees	0.05
India	Market capitalization	0.31	Malaysia	NBFI loans outstanding	-0.13	Sri Lanka	Nonperforming NBFI loans	0.04
Kyrgyz Republic	Market capitalization	0.31	Tajikistan	NBFI loans outstanding	-0.13	Kazakhstan	Bank loans outstanding	0.04
Thailand	Market capitalization	0.29	Philippines	NBFI loans outstanding	-0.14	Malaysia	Market capitalization	0.03
Bangladesh	Market capitalization	0.27	Georgia	Nonperforming bank loans	-0.15	Fiji	MSME loans outstanding	0.03
Kyrgyz Republic	Nonperforming bank loans	0.26	Nepal	Market capitalization	-0.18	Uzbekistan	NBFI loans outstanding	0.03
Lao PDR	Nonperforming bank loans	0.23	Papua New Guinea	Nonperforming bank loans	-0.19	Malaysia	Nonperforming MSME loans	0.03
Viet Nam	Nonperforming NBFI loans	0.23	Brunei Darussalam	Bank loans outstanding	-0.20	Fiji	Market capitalization	0.02
Tajikistan	MSME output	0.21	Myanmar	Number of MSMEs	-0.21	Thailand	Number of MSMEs	0.01
Malaysia	Market capitalization	0.20	Thailand	MSME imports	-0.21	Lao PDR	Bank loans outstanding	0.01
Kazakhstan	MSME output	0.19	Bangladesh	MSME loans outstanding	-0.22	Uzbekistan	Bank loans outstanding	0.01
Uzbekistan	MSME exports	0.16	Singapore	Nonperforming MSME loans	-0.22	Armenia	MSME output	0.00
Singapore	Nonperforming bank loans	0.16	Lao PDR	Nonperforming bank loans	-0.23	Indonesia	Number of MSMEs	-0.01
Philippines	Nonperforming bank loans	0.15	Viet Nam	Nonperforming bank loans	-0.24	Myanmar	Number of MSMEs	-0.01
Bangladesh	Nonperforming bank loans	0.15	Kazakhstan	MSME loans outstanding	-0.25	Singapore	Number of MSMEs	-0.02
Philippines	Market capitalization	0.14	Malaysia	Number of MSMEs	-0.26	Sri Lanka	NBFI loans outstanding	-0.02
Papua New Guinea	Nonperforming NBFI loans	0.13	Pakistan	MSME loans outstanding	-0.26	Papua New Guinea	Bank loans outstanding	-0.03
Sri Lanka	Nonperforming bank loans	0.11	Uzbekistan	MSME imports	-0.27	Brunei Darussalam	NBFI loans outstanding	-0.03
Viet Nam	Number of employees	0.09	Georgia	Bank loans outstanding	-0.27	Uzbekistan	Market capitalization	-0.03
Kyrgyz Republic	Number of employees	0.08	Thailand	Number of MSMEs	-0.28	Singapore	Number of employees	-0.03
Singapore	MSME loans outstanding	0.08	Thailand	MSME output	-0.28	Armenia	Market capitalization	-0.03
Georgia	Nonperforming MSME loans	0.07	Indonesia	Nonperforming MSME loans	-0.30	India	Number of employees	-0.04
Tajikistan	Nonperforming NBFI loans	0.05	Sri Lanka	Nonperforming NBFI loans	-0.31	Viet Nam	Market capitalization	-0.04
Georgia	Nonperforming bank loans	0.05	Thailand	MSME exports	-0.32	Singapore	Nonperforming bank loans	-0.04
India	MSME output	0.03	Armenia	Market capitalization	-0.32	Philippines	Nonperforming MSME loans	-0.05
Tajikistan	Nonperforming bank loans	-0.04	Papua New Guinea	MSME loans outstanding	-0.35	Papua New Guinea	Nonperforming bank loans	-0.05
Bangladesh	Nonperforming NBFI loans	-0.06	Armenia	Number of MSMEs	-0.36	Brunei Darussalam	MSME output	-0.06
Tajikistan	Number of employees	-0.09	Armenia	MSME output	-0.36	Thailand	Market capitalization	-0.07
Pakistan	Market capitalization	-0.09	Cambodia	NBFI loans outstanding	-0.36	Bangladesh	Nonperforming bank loans	-0.09
Kyrgyz Republic	MSME exports	-0.14	Bangladesh	NBFI loans outstanding	-0.36	Cambodia	Market capitalization	-0.09
Tajikistan	Nonperforming MSME loans	-0.15	Azerbaijan	MSME output	-0.37	Fiji	Bank loans outstanding	-0.10
Uzbekistan	Bank loans outstanding	-0.18	India	Nonperforming MSME loans	-0.37	Azerbaijan	Number of MSMEs	-0.12
Lao PDR	Market capitalization	-0.19	Pakistan	Nonperforming NBFI loans	-0.37	India	Nonperforming bank loans	-0.14
India	Nonperforming MSME loans	-0.21	India	Nonperforming NBFI loans	-0.38	Armenia	Nonperforming bank loans	-0.14
Philippines	Nonperforming MSME loans	-0.22	Georgia	MSME loans outstanding	-0.39	Tajikistan	Number of employees	-0.15
India	NBFI loans outstanding	-0.25	Papua New Guinea	Market capitalization	-0.39	Georgia	Nonperforming MSME loans	-0.15
Uzbekistan	Nonperforming NBFI loans	-0.25	Nepal	Bank loans outstanding	-0.41	India	Nonperforming NBFI loans	-0.15
Fiji	Nonperforming bank loans	-0.28	Myanmar	Bank loans outstanding	-0.43	India	Nonperforming MSME loans	-0.16
Uzbekistan	NBFI loans outstanding	-0.28	Samoa	MSME loans outstanding	-0.46	Lao PDR	NBFI loans outstanding	-0.19
India	Nonperforming NBFI loans	-0.28	Indonesia	MSME exports	-0.47	Kyrgyz Republic	Number of employees	-0.20
Uzbekistan	Market capitalization	-0.28	Malaysia	Nonperforming MSME loans	-0.48	Samoa	Nonperforming bank loans	-0.21
Kyrgyz Republic	MSME imports	-0.30	Myanmar	NBFI loans outstanding	-0.49	Philippines	NBFI loans outstanding	-0.21
Lao PDR	MSME loans outstanding	-0.30	Indonesia	Nonperforming bank loans	-0.50	Viet Nam	Bank loans outstanding	-0.22
Uzbekistan	MSME output	-0.31	Kazakhstan	NBFI loans outstanding	-0.50	Malaysia	Nonperforming bank loans	-0.22
Singapore	Number of MSMEs	-0.37	Myanmar	Nonperforming NBFI loans	-0.50	Singapore	NBFI loans outstanding	-0.22
Sri Lanka	Market capitalization	-0.37	Cambodia	Bank loans outstanding	-0.51	Uzbekistan	Nonperforming NBFI loans	-0.22
Malaysia	Number of employees	-0.43	India	Market capitalization	-0.51	Singapore	MSME loans outstanding	-0.23
Azerbaijan	Nonperforming bank loans	-0.44	Georgia	MSME imports	-0.52	Nepal	Market capitalization	-0.24
India	MSME loans outstanding	-0.44	Malaysia	Nonperforming bank loans	-0.52	Azerbaijan	Number of employees	-0.26
Brunei Darussalam	Nonperforming NBFI loans	-0.48	Cambodia	Nonperforming bank loans	-0.53	Brunei Darussalam	Nonperforming NBFI loans	-0.26
Brunei Darussalam	Bank loans outstanding	-0.50	Singapore	MSME loans outstanding	-0.55	Philippines	Market capitalization	-0.28
Pakistan	MSME loans outstanding	-0.50	Fiji	Market capitalization	-0.56	Bangladesh	MSME output	-0.29
Uzbekistan	Nonperforming bank loans	-0.51	Kyrgyz Republic	Number of employees	-0.58	Singapore	Nonperforming MSME loans	-0.30
Samoa	Nonperforming bank loans	-0.52	Bangladesh	MSME output	-0.58	Viet Nam	NBFI loans outstanding	-0.31
Singapore	MSME output	-0.57	Lao PDR	NBFI loans outstanding	-0.58	Pakistan	Bank loans outstanding	-0.32
Papua New Guinea	Market capitalization	-0.57	Kyrgyz Republic	Market capitalization	-0.58	Thailand	Nonperforming bank loans	-0.32
Singapore	Number of employees	-0.58	Viet Nam	Bank loans outstanding	-0.59	Bangladesh	Nonperforming NBFI loans	-0.34
Armenia	Number of MSMEs	-0.59	Bangladesh	Bank loans outstanding	-0.59	Singapore	Bank loans outstanding	-0.35
Papua New Guinea	NBFI loans outstanding	-0.59	Viet Nam	Market capitalization	-0.60	Thailand	Nonperforming MSME loans	-0.35
Tajikistan	NBFI loans outstanding	-0.64	Uzbekistan	Nonperforming bank loans	-0.61	Kazakhstan	MSME loans outstanding	-0.36
Malaysia	MSME exports	-0.65	Malaysia	Market capitalization	-0.61	Tajikistan	Nonperforming NBFI loans	-0.38
Georgia	Market capitalization	-0.65	Indonesia	Bank loans outstanding	-0.62	India	NBFI loans outstanding	-0.39
Malaysia	NBFI loans outstanding	-0.66	Sri Lanka	Nonperforming bank loans	-0.62	Papua New Guinea	Nonperforming NBFI loans	-0.39
Georgia	MSME exports	-0.67	Cambodia	Nonperforming NBFI loans	-0.63	Samoa	MSME loans outstanding	-0.40
Viet Nam	Nonperforming bank loans	-0.67	Papua New Guinea	NBFI loans outstanding	-0.64	Indonesia	MSME loans outstanding	-0.41
Myanmar	Bank loans outstanding	-0.68	Uzbekistan	Number of MSMEs	-0.66	Indonesia	Number of employees	-0.42
Tajikistan	Number of MSMEs	-0.69	Thailand	Nonperforming MSME loans	-0.66	Bangladesh	Bank loans outstanding	-0.42
Georgia	MSME imports	-0.69	Viet Nam	Nonperforming NBFI loans	-0.66	Indonesia	Bank loans outstanding	-0.45
Tajikistan	Bank loans outstanding	-0.69	Philippines	Nonperforming bank loans	-0.67	Lao PDR	MSME loans outstanding	-0.45
Pakistan	Nonperforming bank loans	-0.69	Kyrgyz Republic	Nonperforming bank loans	-0.67	Tajikistan	Bank loans outstanding	-0.46
Pakistan	Nonperforming NBFI loans	-0.69	Georgia	MSME exports	-0.68	Pakistan	Market capitalization	-0.46
Kyrgyz Republic	NBFI loans outstanding	-0.73	India	MSME output	-0.70	Armenia	Number of employees	-0.49
Malaysia	Nonperforming MSME loans	-0.75	Singapore	MSME output	-0.72	India	Market capitalization	-0.49
Brunei Darussalam	NBFI loans outstanding	-0.76	Indonesia	MSME loans outstanding	-0.72	Lao PDR	Market capitalization	-0.52
Thailand	MSME imports	-0.77	Papua New Guinea	Nonperforming NBFI loans	-0.72	Armenia	Number of MSMEs	-0.54
Malaysia	Nonperforming bank loans	-0.77	Cambodia	Market capitalization	-0.72	Bangladesh	MSME loans outstanding	-0.59
Azerbaijan	Bank loans outstanding	-0.78	Azerbaijan	Number of MSMEs	-0.73	Pakistan	NBFI loans outstanding	-0.59
Thailand	MSME exports	-0.79	Thailand	Nonperforming bank loans	-0.73	Tajikistan	Nonperforming MSME loans	-0.61
Georgia	MSME loans outstanding	-0.79	Philippines	Nonperforming MSME loans	-0.73	Indonesia	Nonperforming bank loans	-0.62
Papua New Guinea	MSME loans outstanding	-0.80	Uzbekistan	Market capitalization	-0.73	Tajikistan	Number of MSMEs	-0.65
Armenia	Number of employees	-0.81	India	MSME exports	-0.74	Pakistan	MSME loans outstanding	-0.65
Kazakhstan	MSME loans outstanding	-0.81	India	MSME loans outstanding	-0.78	Malaysia	Number of MSMEs	-0.67
Armenia	MSME output	-0.83	Uzbekistan	Nonperforming NBFI loans	-0.78	Tajikistan	Nonperforming bank loans	-0.67
Tajikistan	MSME loans outstanding	-0.86	Uzbekistan	NBFI loans outstanding	-0.85	Malaysia	NBFI loans outstanding	-0.67
Brunei Darussalam	Nonperforming bank loans	-0.87	Bangladesh	Nonperforming NBFI loans	-0.85	Indonesia	Nonperforming MSME loans	-0.68
Azerbaijan	NBFI loans outstanding	-0.91	Fiji	Nonperforming bank loans	-0.87	Lao PDR	Nonperforming bank loans	-0.70
Kazakhstan	Nonperforming bank loans	-0.93	Georgia	Nonperforming MSME loans	-0.87	Bangladesh	NBFI loans outstanding	-0.70
Pakistan	Nonperforming MSME loans	-0.93	Singapore	Number of MSMEs	-0.92	Tajikistan	NBFI loans outstanding	-0.71
Kazakhstan	Bank loans outstanding	-0.95	Uzbekistan	Bank loans outstanding	-0.93	Samoa	Number of MSMEs	-0.86

Lao PDR = Lao People's Democratic Republic; MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

Table A3.2: Southeast Asia

Country	Variable	PC1	Country	Variable	PC2	Country	Variable	PC3
Indonesia	Number of MSMEs	0.96	Lao PDR	MSME loans outstanding	0.92	Singapore	MSME loans outstanding	0.71
Philippines	Bank loans outstanding	0.96	Lao PDR	Market capitalization	0.89	Brunei Darussalam	Bank loans outstanding	0.68
Indonesia	MSME output	0.89	Viet Nam	Number of employees	0.77	Philippines	Nonperforming bank loans	0.68
Viet Nam	NBFI loans outstanding	0.88	Brunei Darussalam	Nonperforming NBFI loans	0.76	Malaysia	Market capitalization	0.68
Philippines	NBFI loans outstanding	0.87	Philippines	MSME loans outstanding	0.74	Philippines	Market capitalization	0.61
Viet Nam	Number of MSMEs	0.83	Thailand	MSME loans outstanding	0.72	Philippines	Nonperforming MSME loans	0.55
Lao PDR	Bank loans outstanding	0.79	Malaysia	Number of employees	0.71	Singapore	NBFI loans outstanding	0.54
Thailand	Bank loans outstanding	0.73	Singapore	Market capitalization	0.70	Cambodia	Bank loans outstanding	0.49
Cambodia	NBFI loans outstanding	0.73	Malaysia	MSME loans outstanding	0.69	Viet Nam	Nonperforming NBFI loans	0.45
Indonesia	Number of employees	0.70	Brunei Darussalam	NBFI loans outstanding	0.67	Cambodia	Nonperforming bank loans	0.43
Viet Nam	Bank loans outstanding	0.69	Philippines	Number of employees	0.60	Malaysia	Number of employees	0.42
Singapore	Bank loans outstanding	0.67	Malaysia	Bank loans outstanding	0.52	Cambodia	Nonperforming NBFI loans	0.42
Singapore	Nonperforming MSME loans	0.63	Malaysia	MSME output	0.50	Indonesia	Number of employees	0.38
Brunei Darussalam	MSME output	0.60	Thailand	Market capitalization	0.48	Brunei Darussalam	NBFI loans outstanding	0.36
Myanmar	Number of MSMEs	0.55	Indonesia	Number of employees	0.46	Singapore	Bank loans outstanding	0.32
Viet Nam	Market capitalization	0.55	Lao PDR	Bank loans outstanding	0.45	Thailand	Market capitalization	0.30
Thailand	MSME output	0.54	Malaysia	MSME exports	0.42	Philippines	Number of MSMEs	0.29
Indonesia	Nonperforming MSME loans	0.52	Philippines	Number of MSMEs	0.40	Singapore	Nonperforming bank loans	0.25
Indonesia	Nonperforming bank loans	0.51	Indonesia	Market capitalization	0.30	Indonesia	Nonperforming MSME loans	0.24
Indonesia	Bank loans outstanding	0.50	Singapore	Bank loans outstanding	0.28	Cambodia	NBFI loans outstanding	0.23
Malaysia	MSME loans outstanding	0.50	Thailand	Bank loans outstanding	0.28	Singapore	Number of MSMEs	0.18
Philippines	Number of employees	0.49	Philippines	Market capitalization	0.23	Singapore	MSME output	0.18
Cambodia	Bank loans outstanding	0.49	Viet Nam	NBFI loans outstanding	0.20	Brunei Darussalam	Nonperforming NBFI loans	0.18
Philippines	MSME loans outstanding	0.48	Singapore	Number of employees	0.19	Indonesia	MSME loans outstanding	0.17
Lao PDR	NBFI loans outstanding	0.47	Singapore	NBFI loans outstanding	0.19	Malaysia	NBFI loans outstanding	0.14
Thailand	Nonperforming MSME loans	0.45	Thailand	Number of employees	0.18	Viet Nam	Bank loans outstanding	0.12
Myanmar	NBFI loans outstanding	0.45	Indonesia	Number of MSMEs	0.16	Myanmar	NBFI loans outstanding	0.12
Myanmar	Nonperforming NBFI loans	0.43	Viet Nam	Number of MSMEs	0.15	Malaysia	Bank loans outstanding	0.11
Thailand	Number of employees	0.41	Malaysia	Number of MSMEs	0.11	Indonesia	Nonperforming bank loans	0.09
Singapore	Market capitalization	0.41	Brunei Darussalam	MSME output	0.11	Malaysia	MSME loans outstanding	0.09
Indonesia	Market capitalization	0.39	Brunei Darussalam	Nonperforming bank loans	0.10	Singapore	Market capitalization	0.07
Thailand	Number of MSMEs	0.38	Singapore	Nonperforming bank loans	0.09	Indonesia	Bank loans outstanding	0.06
Malaysia	Bank loans outstanding	0.37	Viet Nam	Nonperforming bank loans	0.08	Philippines	Bank loans outstanding	0.06
Thailand	MSME loans outstanding	0.37	Indonesia	MSME output	-0.01	Malaysia	Nonperforming bank loans	0.05
Malaysia	MSME output	0.34	Brunei Darussalam	Bank loans outstanding	-0.03	Philippines	NBFI loans outstanding	0.05
Singapore	NBFI loans outstanding	0.33	Malaysia	NBFI loans outstanding	-0.07	Malaysia	Number of MSMEs	0.04
Thailand	Nonperforming bank loans	0.32	Thailand	MSME imports	-0.08	Thailand	Bank loans outstanding	0.03
Thailand	Market capitalization	0.32	Lao PDR	Nonperforming bank loans	-0.13	Philippines	Number of employees	-0.02
Indonesia	MSME loans outstanding	0.31	Philippines	Bank loans outstanding	-0.20	Thailand	Nonperforming bank loans	-0.04
Philippines	Number of MSMEs	0.28	Thailand	MSME exports	-0.21	Myanmar	Nonperforming NBFI loans	-0.05
Malaysia	Number of MSMEs	0.27	Singapore	Nonperforming MSME loans	-0.24	Cambodia	Market capitalization	-0.06
Cambodia	Nonperforming NBFI loans	0.20	Myanmar	Number of MSMEs	-0.25	Viet Nam	Market capitalization	-0.07
Viet Nam	Number of employees	0.17	Philippines	NBFI loans outstanding	-0.26	Viet Nam	NBFI loans outstanding	-0.07
Cambodia	Nonperforming bank loans	0.16	Indonesia	Nonperforming MSME loans	-0.27	Malaysia	Nonperforming MSME loans	-0.08
Singapore	Nonperforming bank loans	0.15	Myanmar	Bank loans outstanding	-0.28	Lao PDR	NBFI loans outstanding	-0.09
Cambodia	Market capitalization	0.10	Malaysia	Nonperforming MSME loans	-0.32	Lao PDR	Market capitalization	-0.10
Philippines	Market capitalization	0.08	Thailand	MSME output	-0.36	Viet Nam	Number of MSMEs	-0.13
Lao PDR	Market capitalization	0.07	Malaysia	Nonperforming bank loans	-0.37	Myanmar	Bank loans outstanding	-0.13
Indonesia	MSME exports	0.03	Thailand	Number of MSMEs	-0.42	Indonesia	Number of MSMEs	-0.14
Viet Nam	Nonperforming NBFI loans	-0.01	Singapore	MSME loans outstanding	-0.44	Lao PDR	Bank loans outstanding	-0.16
Malaysia	Market capitalization	-0.04	Cambodia	NBFI loans outstanding	-0.49	Viet Nam	Nonperforming bank loans	-0.18
Singapore	MSME loans outstanding	-0.08	Malaysia	Market capitalization	-0.49	Thailand	Nonperforming MSME loans	-0.20
Philippines	Nonperforming bank loans	-0.09	Indonesia	MSME exports	-0.50	Lao PDR	MSME loans outstanding	-0.21
Lao PDR	Nonperforming bank loans	-0.13	Cambodia	Nonperforming bank loans	-0.50	Brunei Darussalam	Nonperforming bank loans	-0.23
Lao PDR	MSME loans outstanding	-0.20	Indonesia	Nonperforming bank loans	-0.53	Malaysia	MSME output	-0.24
Brunei Darussalam	Nonperforming NBFI loans	-0.30	Cambodia	Bank loans outstanding	-0.54	Thailand	MSME exports	-0.28
Malaysia	Number of employees	-0.36	Philippines	Nonperforming bank loans	-0.56	Indonesia	MSME output	-0.29
Philippines	Nonperforming MSME loans	-0.42	Philippines	Nonperforming MSME loans	-0.56	Thailand	Number of MSMEs	-0.30
Singapore	Number of MSMEs	-0.57	Myanmar	NBFI loans outstanding	-0.58	Singapore	Number of employees	-0.30
Brunei Darussalam	Bank loans outstanding	-0.58	Singapore	MSME output	-0.61	Viet Nam	Number of employees	-0.30
Singapore	Number of employees	-0.60	Cambodia	Nonperforming NBFI loans	-0.62	Thailand	MSME output	-0.30
Brunei Darussalam	NBFI loans outstanding	-0.63	Myanmar	Nonperforming NBFI loans	-0.62	Indonesia	Market capitalization	-0.30
Malaysia	MSME exports	-0.65	Viet Nam	Nonperforming NBFI loans	-0.62	Thailand	MSME imports	-0.33
Singapore	MSME output	-0.66	Lao PDR	NBFI loans outstanding	-0.65	Brunei Darussalam	MSME output	-0.38
Malaysia	NBFI loans outstanding	-0.74	Viet Nam	Market capitalization	-0.69	Philippines	MSME loans outstanding	-0.38
Viet Nam	Nonperforming bank loans	-0.80	Viet Nam	Bank loans outstanding	-0.70	Thailand	MSME loans outstanding	-0.44
Myanmar	Bank loans outstanding	-0.83	Indonesia	Bank loans outstanding	-0.72	Malaysia	MSME exports	-0.45
Thailand	MSME imports	-0.85	Thailand	Nonperforming MSME loans	-0.78	Singapore	Nonperforming MSME loans	-0.50
Thailand	MSME exports	-0.88	Singapore	Number of MSMEs	-0.79	Myanmar	Number of MSMEs	-0.57
Malaysia	Nonperforming MSME loans	-0.88	Indonesia	MSME loans outstanding	-0.80	Thailand	Number of employees	-0.59
Malaysia	Nonperforming bank loans	-0.90	Cambodia	Market capitalization	-0.80	Indonesia	MSME exports	-0.74
Brunei Darussalam	Nonperforming bank loans	-0.91	Thailand	Nonperforming bank loans	-0.84	Lao PDR	Nonperforming bank loans	-0.80

Lao PDR = Lao People's Democratic Republic; MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.



Table A3.3: South Asia

Country	Variable	PC1	Country	Variable	PC2	Country	Variable	PC3
India	Number of employees	0.95	Nepal	Number of MSMEs	0.90	Pakistan	NBFI loans outstanding	0.80
Sri Lanka	NBFI loans outstanding	0.90	Bangladesh	MSME loans outstanding	0.79	Pakistan	MSME loans outstanding	0.66
Pakistan	Market capitalization	0.74	India	Nonperforming bank loans	0.78	Bangladesh	NBFI loans outstanding	0.53
Sri Lanka	Market capitalization	0.68	Bangladesh	MSME output	0.75	India	Nonperforming MSME loans	0.50
India	Number of MSMEs	0.66	Pakistan	Bank loans outstanding	0.74	India	NBFI loans outstanding	0.50
Pakistan	MSME output	0.64	Sri Lanka	Bank loans outstanding	0.66	Pakistan	Bank loans outstanding	0.49
Bangladesh	Market capitalization	0.63	Nepal	Number of employees	0.65	Pakistan	Market capitalization	0.48
Sri Lanka	Bank loans outstanding	0.50	Bangladesh	Bank loans outstanding	0.65	Bangladesh	Nonperforming bank loans	0.44
Pakistan	Nonperforming bank loans	0.49	India	Bank loans outstanding	0.63	India	Nonperforming NBFI loans	0.37
Nepal	Number of employees	0.46	Sri Lanka	Nonperforming NBFI loans	0.63	India	Market capitalization	0.29
India	Bank loans outstanding	0.32	Pakistan	MSME output	0.61	India	Nonperforming bank loans	0.27
India	Nonperforming bank loans	0.32	Nepal	Bank loans outstanding	0.60	India	Number of MSMEs	0.26
Pakistan	Bank loans outstanding	0.16	Pakistan	NBFI loans outstanding	0.49	India	MSME output	0.25
Nepal	Number of MSMEs	0.13	India	MSME exports	0.45	Sri Lanka	NBFI loans outstanding	0.13
Pakistan	NBFI loans outstanding	0.13	Bangladesh	NBFI loans outstanding	0.44	India	MSME loans outstanding	0.12
Pakistan	Nonperforming MSME loans	0.07	Nepal	Market capitalization	0.36	India	Number of employees	0.06
Sri Lanka	Nonperforming NBFI loans	-0.16	Sri Lanka	NBFI loans outstanding	0.28	Pakistan	Nonperforming MSME loans	0.03
Nepal	Market capitalization	-0.17	India	Number of MSMEs	0.27	Nepal	Market capitalization	-0.02
Bangladesh	MSME loans outstanding	-0.18	India	Number of employees	0.10	Bangladesh	MSME loans outstanding	-0.04
Bangladesh	Nonperforming bank loans	-0.23	India	Market capitalization	0.05	Bangladesh	Bank loans outstanding	-0.17
Nepal	Bank loans outstanding	-0.28	Bangladesh	Market capitalization	0.05	Pakistan	Nonperforming bank loans	-0.17
Sri Lanka	Nonperforming bank loans	-0.39	Sri Lanka	Nonperforming bank loans	0.05	Nepal	Number of employees	-0.21
Pakistan	Nonperforming NBFI loans	-0.39	Bangladesh	Nonperforming bank loans	-0.07	Sri Lanka	Bank loans outstanding	-0.21
Pakistan	MSME loans outstanding	-0.45	India	Nonperforming MSME loans	-0.08	Pakistan	MSME output	-0.25
Bangladesh	MSME output	-0.55	Bangladesh	Nonperforming NBFI loans	-0.11	Bangladesh	MSME output	-0.26
Bangladesh	Bank loans outstanding	-0.60	India	MSME loans outstanding	-0.14	Sri Lanka	Market capitalization	-0.27
Bangladesh	NBFI loans outstanding	-0.65	India	Nonperforming NBFI loans	-0.20	Nepal	Number of MSMEs	-0.29
India	MSME exports	-0.66	Pakistan	Market capitalization	-0.23	Bangladesh	Nonperforming NBFI loans	-0.29
India	Market capitalization	-0.66	India	MSME output	-0.25	Pakistan	Nonperforming NBFI loans	-0.33
India	NBFI loans outstanding	-0.70	India	NBFI loans outstanding	-0.32	Bangladesh	Market capitalization	-0.37
India	MSME output	-0.71	Sri Lanka	Market capitalization	-0.50	India	MSME exports	-0.40
Bangladesh	Nonperforming NBFI loans	-0.82	Pakistan	MSME loans outstanding	-0.53	Sri Lanka	Nonperforming NBFI loans	-0.53
India	Nonperforming MSME loans	-0.84	Pakistan	Nonperforming NBFI loans	-0.73	India	Bank loans outstanding	-0.61
India	Nonperforming NBFI loans	-0.86	Pakistan	Nonperforming bank loans	-0.83	Nepal	Bank loans outstanding	-0.65
India	MSME loans outstanding	-0.97	Pakistan	Nonperforming MSME loans	-0.98	Sri Lanka	Nonperforming bank loans	-0.66

MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.



Table A3.4: Central and West Asia

Country	Variable	PC1	Country	Variable	PC2	Country	Variable	PC3
Kyrgyz Republic	Bank loans outstanding	0.95	Azerbaijan	Nonperforming bank loans	0.81	Kyrgyz Republic	NBFI loans outstanding	0.66
Kyrgyz Republic	MSME loans outstanding	0.95	Uzbekistan	Number of employees	0.80	Kyrgyz Republic	MSME imports	0.57
Armenia	Bank loans outstanding	0.94	Tajikistan	MSME output	0.76	Kazakhstan	MSME output	0.56
Georgia	Number of MSMEs	0.93	Uzbekistan	MSME output	0.70	Georgia	MSME imports	0.50
Georgia	Bank loans outstanding	0.93	Tajikistan	Nonperforming NBFI loans	0.67	Azerbaijan	MSME output	0.45
Kyrgyz Republic	Number of MSMEs	0.92	Tajikistan	Nonperforming MSME loans	0.63	Georgia	MSME output	0.44
Kazakhstan	Number of MSMEs	0.89	Georgia	Number of employees	0.59	Kyrgyz Republic	MSME output	0.43
Azerbaijan	Number of employees	0.88	Tajikistan	Nonperforming bank loans	0.58	Kyrgyz Republic	MSME exports	0.38
Armenia	NBFI loans outstanding	0.86	Tajikistan	Number of employees	0.57	Kazakhstan	Nonperforming bank loans	0.37
Kazakhstan	Number of employees	0.85	Georgia	MSME output	0.56	Georgia	MSME exports	0.36
Uzbekistan	MSME imports	0.81	Uzbekistan	MSME exports	0.51	Georgia	Market capitalization	0.33
Armenia	Nonperforming bank loans	0.74	Azerbaijan	Bank loans outstanding	0.39	Azerbaijan	Nonperforming bank loans	0.28
Georgia	Number of employees	0.71	Kyrgyz Republic	MSME imports	0.37	Armenia	Bank loans outstanding	0.25
Kyrgyz Republic	MSME output	0.70	Tajikistan	Bank loans outstanding	0.33	Armenia	NBFI loans outstanding	0.23
Uzbekistan	Number of MSMEs	0.67	Armenia	Nonperforming bank loans	0.29	Azerbaijan	Bank loans outstanding	0.19
Georgia	NBFI loans outstanding	0.67	Azerbaijan	NBFI loans outstanding	0.27	Kazakhstan	Bank loans outstanding	0.19
Kazakhstan	NBFI loans outstanding	0.66	Georgia	NBFI loans outstanding	0.26	Uzbekistan	MSME imports	0.18
Azerbaijan	MSME output	0.65	Georgia	Market capitalization	0.26	Uzbekistan	MSME exports	0.17
Armenia	Market capitalization	0.61	Tajikistan	MSME loans outstanding	0.21	Uzbekistan	Number of MSMEs	0.15
Kyrgyz Republic	Market capitalization	0.60	Kazakhstan	Nonperforming bank loans	0.12	Kyrgyz Republic	Nonperforming bank loans	0.14
Uzbekistan	Number of employees	0.56	Georgia	Number of MSMEs	0.11	Armenia	MSME output	0.13
Georgia	MSME output	0.56	Kyrgyz Republic	MSME loans outstanding	0.09	Georgia	Number of employees	0.12
Kazakhstan	MSME output	0.50	Kazakhstan	Number of employees	0.08	Tajikistan	MSME loans outstanding	0.12
Azerbaijan	Number of MSMEs	0.45	Kyrgyz Republic	MSME output	0.07	Kazakhstan	NBFI loans outstanding	0.12
Tajikistan	MSME output	0.45	Kazakhstan	Number of MSMEs	0.05	Georgia	Bank loans outstanding	0.10
Kyrgyz Republic	Nonperforming bank loans	0.42	Kyrgyz Republic	NBFI loans outstanding	0.03	Kyrgyz Republic	Market capitalization	0.09
Uzbekistan	MSME exports	0.39	Azerbaijan	Number of employees	0.02	Tajikistan	MSME output	0.07
Kyrgyz Republic	Number of employees	0.26	Kyrgyz Republic	Bank loans outstanding	0.01	Uzbekistan	MSME output	0.06
Georgia	Nonperforming bank loans	0.25	Armenia	NBFI loans outstanding	-0.04	Azerbaijan	NBFI loans outstanding	0.05
Georgia	Nonperforming MSME loans	0.21	Kazakhstan	Bank loans outstanding	-0.06	Kyrgyz Republic	Number of MSMEs	0.03
Tajikistan	Nonperforming NBFI loans	0.16	Tajikistan	Number of MSMEs	-0.07	Georgia	Nonperforming bank loans	0.03
Tajikistan	Nonperforming bank loans	0.13	Kyrgyz Republic	Number of MSMEs	-0.10	Georgia	Number of MSMEs	0.02
Tajikistan	Number of employees	0.11	Kyrgyz Republic	MSME exports	-0.11	Georgia	MSME loans outstanding	0.01
Uzbekistan	Bank loans outstanding	0.10	Kazakhstan	MSME output	-0.13	Kyrgyz Republic	MSME loans outstanding	0.01
Kyrgyz Republic	MSME exports	0.07	Armenia	Bank loans outstanding	-0.13	Uzbekistan	Nonperforming bank loans	-0.01
Uzbekistan	NBFI loans outstanding	0.01	Georgia	Nonperforming bank loans	-0.16	Uzbekistan	Number of employees	-0.01
Tajikistan	Nonperforming MSME loans	0.01	Armenia	Number of employees	-0.20	Uzbekistan	Market capitalization	-0.02
Uzbekistan	Nonperforming NBFI loans	0.00	Uzbekistan	MSME imports	-0.24	Kyrgyz Republic	Bank loans outstanding	-0.05
Kyrgyz Republic	MSME imports	-0.09	Georgia	Bank loans outstanding	-0.25	Georgia	NBFI loans outstanding	-0.07
Uzbekistan	Market capitalization	-0.18	Tajikistan	NBFI loans outstanding	-0.28	Kazakhstan	Number of employees	-0.12
Uzbekistan	MSME output	-0.25	Kazakhstan	MSME loans outstanding	-0.31	Azerbaijan	Number of MSMEs	-0.13
Uzbekistan	Nonperforming bank loans	-0.25	Armenia	Market capitalization	-0.33	Uzbekistan	Bank loans outstanding	-0.14
Azerbaijan	Nonperforming bank loans	-0.38	Kazakhstan	NBFI loans outstanding	-0.37	Kazakhstan	Number of MSMEs	-0.16
Armenia	Number of MSMEs	-0.47	Azerbaijan	MSME output	-0.42	Kyrgyz Republic	Number of employees	-0.17
Tajikistan	NBFI loans outstanding	-0.52	Armenia	MSME output	-0.43	Georgia	Nonperforming MSME loans	-0.17
Georgia	Market capitalization	-0.56	Georgia	MSME imports	-0.45	Armenia	Market capitalization	-0.20
Georgia	MSME exports	-0.59	Armenia	Number of MSMEs	-0.52	Tajikistan	Number of employees	-0.22
Georgia	MSME imports	-0.59	Georgia	MSME loans outstanding	-0.54	Uzbekistan	NBFI loans outstanding	-0.23
Tajikistan	Number of MSMEs	-0.66	Kyrgyz Republic	Market capitalization	-0.57	Kazakhstan	MSME loans outstanding	-0.26
Tajikistan	Bank loans outstanding	-0.67	Kyrgyz Republic	Nonperforming bank loans	-0.63	Armenia	Nonperforming bank loans	-0.28
Kyrgyz Republic	NBFI loans outstanding	-0.68	Uzbekistan	Number of MSMEs	-0.64	Azerbaijan	Number of employees	-0.32
Georgia	MSME loans outstanding	-0.69	Kyrgyz Republic	Number of employees	-0.65	Uzbekistan	Nonperforming NBFI loans	-0.36
Armenia	MSME output	-0.76	Georgia	MSME exports	-0.69	Tajikistan	Nonperforming NBFI loans	-0.47
Kazakhstan	MSME loans outstanding	-0.79	Azerbaijan	Number of MSMEs	-0.72	Armenia	Number of employees	-0.49
Armenia	Number of employees	-0.81	Uzbekistan	Nonperforming bank loans	-0.80	Tajikistan	Bank loans outstanding	-0.54
Azerbaijan	Bank loans outstanding	-0.81	Georgia	Nonperforming MSME loans	-0.83	Armenia	Number of MSMEs	-0.56
Tajikistan	MSME loans outstanding	-0.85	Uzbekistan	Nonperforming NBFI loans	-0.84	Tajikistan	Nonperforming MSME loans	-0.57
Kazakhstan	Nonperforming bank loans	-0.88	Uzbekistan	Market capitalization	-0.88	Tajikistan	Number of MSMEs	-0.70
Azerbaijan	NBFI loans outstanding	-0.94	Uzbekistan	NBFI loans outstanding	-0.94	Tajikistan	NBFI loans outstanding	-0.70
Kazakhstan	Bank loans outstanding	-0.96	Uzbekistan	Bank loans outstanding	-0.97	Tajikistan	Nonperforming bank loans	-0.77

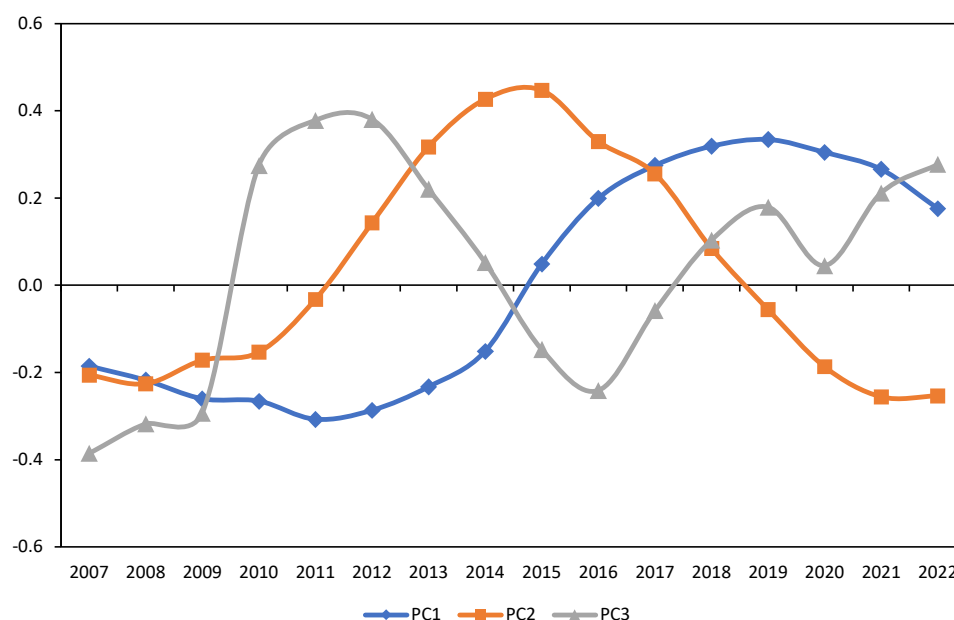
MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

## Appendix 4: Robustness Test. A Standard Principal Component Analysis with Expectation–Maximization Algorithm

This appendix shows a robustness check by applying another variant of probabilistic principal component analysis (P-PCA) to aggregate data of 25 countries. More specifically, we applied a standard principal component analysis (PCA) after the estimation of the expectation–maximization (EM) algorithm. This alternative method repeatedly applies the singular value decomposition to fill in the data initially missing. The estimation results are similar to those in the P-PCA estimates for all countries (Figure A4.1 and Tables A4.1 to A4.3).

**Figure A4.1: Time Series Plots of Estimated Principal Components—Robustness Test**



PC = principal component.

Source: Calculated based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

**Table A4.1: Time Series Plots of Estimated Principal Components—Robustness Test**

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
PC1	-0.19	-0.22	-0.26	-0.27	-0.31	-0.29	-0.23	-0.15	0.05	0.20	0.28	0.32	0.33	0.30	0.27	0.18
PC2	-0.21	-0.23	-0.17	-0.15	-0.03	0.14	0.32	0.43	0.45	0.33	0.26	0.08	-0.06	-0.19	-0.26	-0.25
PC3	-0.39	-0.32	-0.29	0.27	0.38	0.38	0.22	0.05	-0.15	-0.24	-0.06	0.10	0.18	0.05	0.21	0.28

PC = principal component.

Source: Calculated based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

**Table A4.2: Contribution of Each Estimated Principal Component—Robustness Test**

Item	PC1	PC2	PC3
Eigenvalue	6.10	3.48	1.98
Contribution ratio	0.38	0.22	0.12
Cumulative contribution rate	0.38	0.60	0.72

PC = principal component.

Source: Calculated based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

**Table A4.3: Factor Loadings Based on Alternative Principal Component Analysis—Robustness Test**

Country	Variable	PC1	Country	Variable	PC2	Country	Variable	PC3
Indonesia	Number of MSMEs	0.12	Uzbekistan	Bank loans outstanding	0.14	Samoa	Number of MSMEs	0.19
Philippines	Bank loans outstanding	0.12	Georgia	Nonperforming MSME loans	0.13	Lao PDR	Nonperforming bank loans	0.17
Nepal	Number of MSMEs	0.12	Bangladesh	Nonperforming NBFI loans	0.13	Pakistan	NBFI loans outstanding	0.16
Viet Nam	Number of MSMEs	0.12	Singapore	Number of MSMEs	0.13	Bangladesh	NBFI loans outstanding	0.16
Georgia	Number of MSMEs	0.12	Uzbekistan	NBFI loans outstanding	0.13	Tajikistan	Nonperforming bank loans	0.16
Fiji	Bank loans outstanding	0.12	Fiji	Nonperforming bank loans	0.13	Pakistan	MSME loans outstanding	0.16
Indonesia	MSME output	0.12	Azerbaijan	Number of MSMEs	0.12	Tajikistan	Nonperforming MSME loans	0.15
Kyrgyz Republic	MSME loans outstanding	0.12	Uzbekistan	Nonperforming NBFI loans	0.12	Indonesia	Nonperforming MSME loans	0.15
Kyrgyz Republic	Bank loans outstanding	0.12	Indonesia	MSME loans outstanding	0.12	Indonesia	Nonperforming bank loans	0.14
Philippines	NBFI loans outstanding	0.11	Papua New Guinea	Nonperforming NBFI loans	0.12	Malaysia	Number of MSMEs	0.14
Nepal	Number of employees	0.11	Thailand	Nonperforming bank loans	0.11	Tajikistan	NBFI loans outstanding	0.14
India	Bank loans outstanding	0.11	Philippines	Nonperforming MSME loans	0.11	Malaysia	NBFI loans outstanding	0.13
Kyrgyz Republic	Number of MSMEs	0.11	India	MSME exports	0.11	Tajikistan	Number of MSMEs	0.13
Cambodia	NBFI loans outstanding	0.11	Uzbekistan	Market capitalization	0.11	Pakistan	Market capitalization	0.12
India	Nonperforming bank loans	0.11	Philippines	Nonperforming bank loans	0.11	Lao PDR	Market capitalization	0.12
Viet Nam	NBFI loans outstanding	0.11	Cambodia	Market capitalization	0.11	Bangladesh	MSME loans outstanding	0.12
Lao PDR	Bank loans outstanding	0.11	Uzbekistan	Number of MSMEs	0.11	Lao PDR	MSME loans outstanding	0.12
Pakistan	MSME output	0.10	India	MSME loans outstanding	0.11	Tajikistan	Nonperforming NBFI loans	0.11
Azerbaijan	Number of employees	0.10	Viet Nam	Nonperforming NBFI loans	0.11	India	Market capitalization	0.11
Sri Lanka	Bank loans outstanding	0.10	India	MSME output	0.10	India	NBFI loans outstanding	0.10
Fiji	MSME loans outstanding	0.10	Thailand	Nonperforming MSME loans	0.10	Pakistan	Bank loans outstanding	0.10
Myanmar	Number of MSMEs	0.10	Cambodia	Nonperforming NBFI loans	0.10	Armenia	Number of MSMEs	0.10
Georgia	Bank loans outstanding	0.10	Indonesia	Bank loans outstanding	0.10	Singapore	Nonperforming MSME loans	0.09
Thailand	Bank loans outstanding	0.10	Sri Lanka	Nonperforming bank loans	0.10	Indonesia	Number of employees	0.09
Kazakhstan	Number of employees	0.10	Bangladesh	Bank loans outstanding	0.10	Indonesia	Bank loans outstanding	0.09
Nepal	Bank loans outstanding	0.10	Kyrgyz Republic	Nonperforming bank loans	0.10	Thailand	Nonperforming MSME loans	0.09
Pakistan	Bank loans outstanding	0.10	Malaysia	Market capitalization	0.10	Armenia	Number of employees	0.09
Armenia	Bank loans outstanding	0.09	Singapore	MSME output	0.10	Viet Nam	NBFI loans outstanding	0.08
Samoa	Bank loans outstanding	0.09	Bangladesh	MSME output	0.10	Azerbaijan	Number of employees	0.08
Sri Lanka	Nonperforming NBFI loans	0.09	Viet Nam	Bank loans outstanding	0.10	Tajikistan	Bank loans outstanding	0.08
Viet Nam	Bank loans outstanding	0.09	Singapore	MSME loans outstanding	0.09	Thailand	Nonperforming bank loans	0.08
Papua New Guinea	Nonperforming bank loans	0.09	Kyrgyz Republic	Number of employees	0.09	Indonesia	MSME loans outstanding	0.08
Armenia	NBFI loans outstanding	0.09	Viet Nam	Market capitalization	0.09	Bangladesh	Bank loans outstanding	0.08
India	Number of MSMEs	0.09	Papua New Guinea	NBFI loans outstanding	0.09	Papua New Guinea	Nonperforming NBFI loans	0.07
Kazakhstan	Number of MSMEs	0.09	Georgia	MSME exports	0.09	Samoa	MSME loans outstanding	0.07
Bangladesh	MSME output	0.09	Lao PDR	NBFI loans outstanding	0.09	Kazakhstan	MSME loans outstanding	0.07
Bangladesh	MSME loans outstanding	0.09	Uzbekistan	Nonperforming bank loans	0.09	India	Nonperforming bank loans	0.07
Myanmar	Nonperforming NBFI loans	0.09	Kyrgyz Republic	Market capitalization	0.09	Brunei Darussalam	Nonperforming MSME loans	0.06
Cambodia	Bank loans outstanding	0.08	Cambodia	Bank loans outstanding	0.09	Bangladesh	MSME output	0.06
Viet Nam	Market capitalization	0.08	Cambodia	Nonperforming bank loans	0.09	Philippines	Market capitalization	0.06
Armenia	Nonperforming bank loans	0.08	Fiji	Market capitalization	0.09	Nepal	Market capitalization	0.06
Uzbekistan	MSME imports	0.08	Indonesia	Nonperforming bank loans	0.09	Singapore	Bank loans outstanding	0.06
Myanmar	NBFI loans outstanding	0.08	Samoa	MSME loans outstanding	0.08	Philippines	NBFI loans outstanding	0.06
Georgia	Number of employees	0.08	India	Market capitalization	0.08	Bangladesh	Nonperforming NBFI loans	0.05
Kazakhstan	NBFI loans outstanding	0.08	Myanmar	Nonperforming NBFI loans	0.08	India	Nonperforming MSME loans	0.05
Thailand	MSME output	0.08	Myanmar	NBFI loans outstanding	0.08	Viet Nam	Bank loans outstanding	0.05
Singapore	Bank loans outstanding	0.08	Kazakhstan	NBFI loans outstanding	0.08	Armenia	Nonperforming bank loans	0.05
Bangladesh	Bank loans outstanding	0.08	Malaysia	Nonperforming bank loans	0.07	Sri Lanka	NBFI loans outstanding	0.05
Singapore	Nonperforming MSME loans	0.08	Nepal	Bank loans outstanding	0.07	India	Nonperforming NBFI loans	0.04
Fiji	Market capitalization	0.07	Indonesia	MSME exports	0.06	Malaysia	Nonperforming bank loans	0.04
Lao PDR	NBFI loans outstanding	0.07	Georgia	MSME imports	0.06	Fiji	Bank loans outstanding	0.04
Brunei Darussalam	MSME output	0.07	Cambodia	NBFI loans outstanding	0.06	Samoa	Nonperforming bank loans	0.04
Kyrgyz Republic	MSME output	0.07	Azerbaijan	MSME output	0.06	Lao PDR	NBFI loans outstanding	0.04
Philippines	Number of employees	0.07	Bangladesh	NBFI loans outstanding	0.06	Myanmar	Number of MSMEs	0.04
Sri Lanka	NBFI loans outstanding	0.07	Armenia	Number of MSMEs	0.06	India	Number of employees	0.04
Pakistan	NBFI loans outstanding	0.07	Indonesia	Nonperforming MSME loans	0.06	Uzbekistan	Nonperforming NBFI loans	0.03
Papua New Guinea	Bank loans outstanding	0.07	Malaysia	Nonperforming MSME loans	0.06	Bangladesh	Nonperforming bank loans	0.03
Malaysia	MSME loans outstanding	0.07	Myanmar	Bank loans outstanding	0.06	Tajikistan	Number of employees	0.03
Indonesia	Bank loans outstanding	0.06	Sri Lanka	Nonperforming NBFI loans	0.05	Kyrgyz Republic	Number of employees	0.03
Bangladesh	NBFI loans outstanding	0.06	Armenia	Market capitalization	0.05	Brunei Darussalam	MSME output	0.03
Thailand	Nonperforming MSME loans	0.06	Georgia	Bank loans outstanding	0.05	Lao PDR	Bank loans outstanding	0.02
Indonesia	Number of employees	0.06	India	Nonperforming NBFI loans	0.05	Fiji	MSME loans outstanding	0.02
Philippines	MSME loans outstanding	0.06	Georgia	MSME loans outstanding	0.05	Thailand	Number of MSMEs	0.02
Thailand	Number of employees	0.06	Bangladesh	MSME loans outstanding	0.05	Georgia	Nonperforming MSME loans	0.02
Uzbekistan	Number of employees	0.06	Pakistan	Nonperforming NBFI loans	0.05	Indonesia	Number of MSMEs	0.02
Malaysia	MSME output	0.06	Malaysia	Number of MSMEs	0.05	Georgia	Number of MSMEs	0.02
Thailand	Number of MSMEs	0.06	India	Nonperforming MSME loans	0.05	Sri Lanka	Bank loans outstanding	0.02
Nepal	Market capitalization	0.06	Uzbekistan	MSME imports	0.05	Viet Nam	Market capitalization	0.01
Azerbaijan	MSME output	0.06	Papua New Guinea	MSME loans outstanding	0.05	Thailand	Market capitalization	0.01
Indonesia	MSME exports	0.06	Papua New Guinea	Market capitalization	0.05	Singapore	Nonperforming bank loans	0.01
Malaysia	Bank loans outstanding	0.06	Thailand	Number of MSMEs	0.05	Azerbaijan	Number of MSMEs	0.01
Georgia	MSME output	0.06	Armenia	MSME output	0.05	Cambodia	Market capitalization	0.01
Indonesia	Nonperforming bank loans	0.05	Thailand	MSME output	0.04	Singapore	NBFI loans outstanding	0.01
Thailand	Nonperforming bank loans	0.05	Myanmar	Number of MSMEs	0.04	Singapore	MSME loans outstanding	0.01
Uzbekistan	Number of MSMEs	0.05	Papua New Guinea	Nonperforming bank loans	0.04	Uzbekistan	Number of employees	0.00
India	Number of employees	0.05	Brunei Darussalam	Bank loans outstanding	0.04	Kazakhstan	NBFI loans outstanding	0.00
Indonesia	Nonperforming MSME loans	0.05	Nepal	Market capitalization	0.04	Pakistan	Nonperforming MSME loans	0.00
Singapore	Market capitalization	0.05	Lao PDR	Nonperforming bank loans	0.04	Pakistan	MSME output	0.00
Indonesia	Market capitalization	0.05	Pakistan	MSME loans outstanding	0.03	Fiji	Market capitalization	0.00
Philippines	Number of MSMEs	0.05	Kazakhstan	MSME loans outstanding	0.03	Singapore	Number of employees	0.00
Thailand	MSME loans outstanding	0.05	Philippines	NBFI loans outstanding	0.03	Papua New Guinea	Bank loans outstanding	-0.01
Samoa	Number of MSMEs	0.05	Thailand	MSME exports	0.03	Armenia	Market capitalization	-0.01
Singapore	NBFI loans outstanding	0.05	Georgia	Nonperforming bank loans	0.03	Brunei Darussalam	Nonperforming bank loans	-0.01
Indonesia	MSME loans outstanding	0.05	Singapore	Nonperforming MSME loans	0.03	Philippines	Bank loans outstanding	-0.01
Cambodia	Nonperforming NBFI loans	0.05	Armenia	Bank loans outstanding	0.02	Malaysia	Nonperforming MSME loans	-0.01
Cambodia	Market capitalization	0.04	Samoa	Number of MSMEs	0.02	India	Number of MSMEs	-0.01
Samoa	MSME loans outstanding	0.04	Viet Nam	Nonperforming bank loans	0.02	Kazakhstan	Number of employees	-0.01
India	MSME exports	0.04	Tajikistan	NBFI loans outstanding	0.02	Kyrgyz Republic	MSME loans outstanding	-0.01
Georgia	NBFI loans outstanding	0.04	Malaysia	NBFI loans outstanding	0.02	Pakistan	Nonperforming NBFI loans	-0.01
Cambodia	Nonperforming bank loans	0.04	Philippines	Bank loans outstanding	0.02	Georgia	Market capitalization	-0.01
Armenia	Market capitalization	0.04	Kyrgyz Republic	Number of MSMEs	0.02	Philippines	Nonperforming MSME loans	-0.01

Continued on next page

continued

Country	Variable	PC1	Country	Variable	PC2	Country	Variable	PC3
Thailand	Market capitalization	0.04	Thailand	MSME imports	0.01	Georgia	Nonperforming bank loans	-0.01
Bangladesh	Market capitalization	0.04	Armenia	Number of employees	0.01	Myanmar	Bank loans outstanding	-0.01
Malaysia	Number of MSMEs	0.04	Tajikistan	Number of MSMEs	0.01	Georgia	Number of employees	-0.01
Kyrgyz Republic	Market capitalization	0.04	Kyrgyz Republic	MSME exports	0.01	Kyrgyz Republic	Number of MSMEs	-0.01
Azerbaijan	Number of MSMEs	0.03	Kazakhstan	MSME output	0.01	Thailand	MSME exports	-0.01
Tajikistan	MSME output	0.03	Armenia	NBFI loans outstanding	0.01	Singapore	Number of MSMEs	-0.01
India	Market capitalization	0.03	India	NBFI loans outstanding	0.01	Armenia	MSME output	-0.01
Kyrgyz Republic	Nonperforming bank loans	0.03	Kyrgyz Republic	Bank loans outstanding	0.01	Papua New Guinea	Nonperforming bank loans	-0.01
Viet Nam	Nonperforming NBFI loans	0.03	Indonesia	MSME output	0.00	Brunei Darussalam	NBFI loans outstanding	-0.01
Kazakhstan	MSME output	0.03	Nepal	Number of MSMEs	0.00	Singapore	Market capitalization	-0.02
Uzbekistan	MSME exports	0.03	Singapore	Nonperforming bank loans	0.00	Sri Lanka	Nonperforming NBFI loans	-0.02
Lao PDR	Nonperforming bank loans	0.03	Kazakhstan	Number of MSMEs	0.00	Uzbekistan	Bank loans outstanding	-0.02
Malaysia	Market capitalization	0.02	Singapore	NBFI loans outstanding	0.00	Malaysia	Number of employees	-0.02
Singapore	Nonperforming bank loans	0.02	Azerbaijan	Number of employees	0.00	Azerbaijan	Nonperforming bank loans	-0.02
Viet Nam	Number of employees	0.02	Brunei Darussalam	MSME output	0.00	Thailand	MSME output	-0.02
Bangladesh	Nonperforming bank loans	0.02	Brunei Darussalam	Nonperforming bank loans	-0.01	Tajikistan	MSME loans outstanding	-0.02
Philippines	Market capitalization	0.02	Bangladesh	Nonperforming bank loans	-0.01	Azerbaijan	NBFI loans outstanding	-0.03
Philippines	Nonperforming bank loans	0.01	India	Bank loans outstanding	-0.01	Kazakhstan	Bank loans outstanding	-0.03
Sri Lanka	Nonperforming bank loans	0.01	Singapore	Bank loans outstanding	-0.01	India	MSME output	-0.03
Tajikistan	Nonperforming NBFI loans	0.01	Kazakhstan	Bank loans outstanding	-0.01	Kazakhstan	Number of MSMEs	-0.03
Papua New Guinea	Nonperforming NBFI loans	0.01	Kazakhstan	Number of employees	-0.01	Uzbekistan	NBFI loans outstanding	-0.03
Kyrgyz Republic	Number of employees	0.01	Philippines	Market capitalization	-0.02	Philippines	MSME loans outstanding	-0.03
Singapore	MSME loans outstanding	0.01	Pakistan	Bank loans outstanding	-0.02	Cambodia	NBFI loans outstanding	-0.03
Georgia	Nonperforming bank loans	0.00	Viet Nam	Number of MSMEs	-0.02	Kyrgyz Republic	Bank loans outstanding	-0.03
Georgia	Nonperforming MSME loans	0.00	Kyrgyz Republic	MSME output	-0.02	Cambodia	Nonperforming NBFI loans	-0.03
India	MSME output	0.00	Indonesia	Number of MSMEs	-0.02	Malaysia	Market capitalization	-0.03
Tajikistan	Nonperforming bank loans	0.00	Georgia	Number of MSMEs	-0.02	Viet Nam	Number of employees	-0.03
Tajikistan	Number of employees	-0.01	Viet Nam	NBFI loans outstanding	-0.02	Nepal	Number of MSMEs	-0.03
Pakistan	Market capitalization	-0.01	Kyrgyz Republic	NBFI loans outstanding	-0.02	Thailand	MSME loans outstanding	-0.03
Bangladesh	Nonperforming NBFI loans	-0.02	Kyrgyz Republic	MSME loans outstanding	-0.02	Tajikistan	MSME output	-0.03
Kyrgyz Republic	MSME exports	-0.02	Pakistan	Nonperforming MSME loans	-0.03	Uzbekistan	Market capitalization	-0.04
Tajikistan	Nonperforming MSME loans	-0.02	Thailand	Bank loans outstanding	-0.03	Uzbekistan	MSME output	-0.04
Lao PDR	Market capitalization	-0.02	Pakistan	NBFI loans outstanding	-0.03	Singapore	MSME output	-0.04
Uzbekistan	Bank loans outstanding	-0.03	Fiji	Bank loans outstanding	-0.04	Samoa	Bank loans outstanding	-0.04
India	Nonperforming MSME loans	-0.03	Singapore	Number of employees	-0.04	Pakistan	Nonperforming bank loans	-0.04
Kyrgyz Republic	MSME imports	-0.03	Kazakhstan	Nonperforming bank loans	-0.04	Philippines	Nonperforming bank loans	-0.04
Philippines	Nonperforming MSME loans	-0.03	India	Nonperforming bank loans	-0.04	Indonesia	MSME output	-0.04
India	NBFI loans outstanding	-0.03	Thailand	Number of employees	-0.04	Nepal	Number of employees	-0.04
Uzbekistan	MSME output	-0.03	Nepal	Number of employees	-0.04	Papua New Guinea	MSME loans outstanding	-0.04
Lao PDR	MSME loans outstanding	-0.03	Armenia	Nonperforming bank loans	-0.04	Thailand	MSME imports	-0.04
Uzbekistan	Nonperforming NBFI loans	-0.04	Georgia	NBFI loans outstanding	-0.04	Malaysia	MSME exports	-0.05
India	Nonperforming NBFI loans	-0.04	Philippines	Number of MSMEs	-0.04	Viet Nam	Number of MSMEs	-0.05
Uzbekistan	Market capitalization	-0.04	Fiji	MSME loans outstanding	-0.04	India	MSME exports	-0.05
Uzbekistan	NBFI loans outstanding	-0.04	Samoa	Nonperforming bank loans	-0.04	Kyrgyz Republic	MSME exports	-0.05
Fiji	Nonperforming bank loans	-0.04	Georgia	Market capitalization	-0.04	Fiji	Nonperforming bank loans	-0.05
Sri Lanka	Market capitalization	-0.04	Indonesia	Market capitalization	-0.05	Azerbaijan	Bank loans outstanding	-0.05
Malaysia	Number of employees	-0.05	Tajikistan	MSME loans outstanding	-0.05	Kazakhstan	Nonperforming bank loans	-0.05
Azerbaijan	Nonperforming bank loans	-0.05	Sri Lanka	Bank loans outstanding	-0.05	Uzbekistan	Nonperforming bank loans	-0.05
Singapore	Number of MSMEs	-0.05	Samoa	Bank loans outstanding	-0.05	India	MSME loans outstanding	-0.05
Brunei Darussalam	Nonperforming NBFI loans	-0.06	Malaysia	MSME output	-0.05	Thailand	Number of employees	-0.05
India	MSME loans outstanding	-0.06	Azerbaijan	NBFI loans outstanding	-0.05	Sri Lanka	Market capitalization	-0.05
Brunei Darussalam	Bank loans outstanding	-0.06	Tajikistan	Bank loans outstanding	-0.05	Malaysia	MSME loans outstanding	-0.06
Samoa	Nonperforming bank loans	-0.07	Malaysia	MSME exports	-0.06	Cambodia	Nonperforming bank loans	-0.06
Pakistan	MSME loans outstanding	-0.07	Pakistan	MSME output	-0.06	Cambodia	Bank loans outstanding	-0.06
Uzbekistan	Nonperforming bank loans	-0.07	Malaysia	Bank loans outstanding	-0.06	Georgia	MSME loans outstanding	-0.06
Singapore	Number of employees	-0.07	Bangladesh	Market capitalization	-0.06	Uzbekistan	MSME exports	-0.06
Papua New Guinea	Market capitalization	-0.07	India	Number of MSMEs	-0.06	Brunei Darussalam	Bank loans outstanding	-0.07
Singapore	MSME output	-0.08	Azerbaijan	Bank loans outstanding	-0.07	Viet Nam	Nonperforming NBFI loans	-0.07
Papua New Guinea	NBFI loans outstanding	-0.08	Kyrgyz Republic	MSME imports	-0.07	Georgia	NBFI loans outstanding	-0.07
Malaysia	MSME exports	-0.08	Brunei Darussalam	NBFI loans outstanding	-0.07	Uzbekistan	MSME imports	-0.07
Armenia	Number of MSMEs	-0.08	Thailand	Market capitalization	-0.07	Nepal	Bank loans outstanding	-0.07
Georgia	Market capitalization	-0.08	Indonesia	Number of employees	-0.08	Philippines	Number of employees	-0.07
Pakistan	Nonperforming bank loans	-0.08	Pakistan	Nonperforming bank loans	-0.08	Georgia	MSME exports	-0.07
Tajikistan	NBFI loans outstanding	-0.09	Brunei Darussalam	Nonperforming NBFI loans	-0.08	Georgia	MSME imports	-0.08
Viet Nam	Nonperforming bank loans	-0.09	Uzbekistan	MSME exports	-0.08	India	Bank loans outstanding	-0.08
Tajikistan	Bank loans outstanding	-0.09	Lao PDR	Bank loans outstanding	-0.08	Kyrgyz Republic	Market capitalization	-0.08
Malaysia	NBFI loans outstanding	-0.09	Philippines	Number of employees	-0.08	Myanmar	NBFI loans outstanding	-0.08
Georgia	MSME exports	-0.09	Sri Lanka	Market capitalization	-0.09	Viet Nam	Nonperforming bank loans	-0.08
Kyrgyz Republic	NBFI loans outstanding	-0.09	Tajikistan	Nonperforming bank loans	-0.09	Georgia	Bank loans outstanding	-0.09
Pakistan	Nonperforming NBFI loans	-0.09	Tajikistan	Nonperforming MSME loans	-0.09	Kyrgyz Republic	Nonperforming bank loans	-0.09
Georgia	MSME imports	-0.09	Malaysia	Number of employees	-0.09	Papua New Guinea	NBFI loans outstanding	-0.09
Myanmar	Bank loans outstanding	-0.09	Tajikistan	Number of employees	-0.09	Indonesia	MSME exports	-0.09
Tajikistan	Number of MSMEs	-0.09	Papua New Guinea	Bank loans outstanding	-0.09	Kyrgyz Republic	MSME imports	-0.09
Brunei Darussalam	NBFI loans outstanding	-0.09	Singapore	Market capitalization	-0.10	Myanmar	Nonperforming NBFI loans	-0.09
Azerbaijan	Bank loans outstanding	-0.09	Malaysia	MSME loans outstanding	-0.10	Kyrgyz Republic	MSME output	-0.09
Thailand	MSME imports	-0.10	Tajikistan	Nonperforming NBFI loans	-0.10	Georgia	MSME output	-0.09
Malaysia	Nonperforming MSME loans	-0.10	Uzbekistan	MSME output	-0.10	Uzbekistan	Number of MSMEs	-0.09
Thailand	MSME exports	-0.10	Pakistan	Market capitalization	-0.11	Bangladesh	Market capitalization	-0.10
Georgia	MSME loans outstanding	-0.10	Georgia	MSME output	-0.11	Armenia	NBFI loans outstanding	-0.10
Malaysia	Nonperforming bank loans	-0.10	Georgia	Number of employees	-0.11	Sri Lanka	Nonperforming bank loans	-0.10
Papua New Guinea	MSME loans outstanding	-0.10	Lao PDR	MSME loans outstanding	-0.11	Thailand	Bank loans outstanding	-0.11
Armenia	Number of employees	-0.11	Sri Lanka	NBFI loans outstanding	-0.11	Armenia	Bank loans outstanding	-0.12
Tajikistan	MSME loans outstanding	-0.11	Lao PDR	Market capitalization	-0.12	Philippines	Number of MSMEs	-0.13
Kazakhstan	MSME loans outstanding	-0.11	Philippines	MSME loans outstanding	-0.12	Kyrgyz Republic	NBFI loans outstanding	-0.13
Armenia	MSME output	-0.11	Thailand	MSME loans outstanding	-0.12	Indonesia	Market capitalization	-0.13
Brunei Darussalam	Nonperforming bank loans	-0.11	Tajikistan	MSME output	-0.13	Azerbaijan	MSME output	-0.13
Azerbaijan	NBFI loans outstanding	-0.11	Uzbekistan	Number of employees	-0.13	Papua New Guinea	Market capitalization	-0.14
Kazakhstan	Nonperforming bank loans	-0.12	India	Number of employees	-0.13	Malaysia	MSME output	-0.14
Pakistan	Nonperforming MSME loans	-0.12	Viet Nam	Number of employees	-0.13	Kazakhstan	MSME output	-0.16
Kazakhstan	Bank loans outstanding	-0.12	Azerbaijan	Nonperforming bank loans	-0.14	Malaysia	Bank loans outstanding	-0.16

Lao PDR = Lao People's Democratic Republic; MSME = micro, small, and medium-sized enterprise; NBFI = nonbank finance institution.

Source: Authors' calculation based on ADB Asia Small and Medium-Sized Enterprise Monitor 2023 database.

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## **Factors Affecting Micro, Small, and Medium-Sized Enterprise Development in Developing Asia**

*Findings from a Probabilistic Principal Component Analysis*

To identify factors affecting micro, small, and medium-sized enterprise (MSME) development, this paper proposes a probabilistic principal component analysis method that works despite current data limitations. The estimation results suggest that sound MSME credit markets, diversified financing options, support for new businesses and job creation, and active MSME participation in global marketplaces play a critical role in ensuring a smooth business recovery from various crises and shocks affecting developing Asia and the Pacific.

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