FINANCE
Finance matters to middle-income transitions, particularly the way in which it is structured. Our analysis of episodes of sustained strong growth shows that high levels of private-sector credit as a percentage of GDP are less likely to be associated with economic out-performance and more likely to be linked to poor performance. This relationship actually predates the global financial crisis of 2008-09. The depth of equity markets, in contrast, has a positive correlation with robust economic growth. Deeper equity markets are also associated with a gradual decline in CO₂ emissions, especially in relatively polluting industries, while the opposite is true for debt markets.

The maturities of domestic bonds issued in emerging markets are, on average, more than 2 years shorter than those of equivalent bonds in advanced economies.
QUANTITY VERSUS QUALITY OF FINANCE

An extensive body of literature provides convincing evidence that financial development – the emergence and growth of banking sectors and stock markets – has a causal and positive impact on long-term growth in low-income economies, mainly by fostering total factor productivity (the efficiency with which various factors of production are combined).

In the case of middle-income transitions, however, the evidence suggests that the structure, or “quality”, of finance is becoming increasingly important. A few decades ago, many middle-income economies had relatively shallow financial markets. More recently, there have been growing concerns about the over-indebtedness of emerging markets. Corporate debt in large middle-income economies has increased substantially and, in some cases, now exceeds that of advanced economies as a percentage of GDP (see Chart 8.1).

Our analysis of episodes of sustained strong growth, discussed earlier in this report, shows that deepening private-sector credit as a percentage of GDP tends to make economic out-performance less likely and poor performance more likely. This relationship actually predates the global financial crisis of 2008-09.

The depth of equity markets, in contrast, is positively correlated with strong economic growth. This is in part due to banks’ propensity to support older, tested technologies. On the other hand, private equity venture capital, seed capital and other equity instruments are better suited to be deployed to back innovative, forward-looking ideas. In addition, technological change has heightened the importance of investment in assets such as research and development, software, patents and licences, which may be difficult to value or collateralise. Such “intangible” investments rely heavily on specialised forms of non-bank finance.

While the success of middle-income transitions may have become less dependent on an abundance of debt finance, it remains crucial that financial crises are managed well.1 In this regard, the provision of longer-term finance and financing in local currency can reduce the vulnerability of middle-income economies to external shocks. In countries where non-performing loan (NPL) levels are high, swift resolution is associated with a substantial growth dividend.2

Longer maturities can also help to create more stable financial structures. Paradoxically, the average maturity of debt at issuance nowadays tends to be shorter in countries with higher GDP per capita and higher private credit-to-GDP ratios.3 This unexpected finding is driven by the composition of debt. The maturities of bonds issued domestically in emerging markets are, on average, more than two years shorter than those of equivalent bonds in advanced economies. However, fewer firms tap domestic bond markets in middle-income economies.4 Firms that raise finance abroad do so at significantly longer maturities, whether in the form of bond issuance or syndicated loans. In part, this is because proceeds are often used for infrastructure projects with long payback periods. In addition, emerging-market borrowers in international markets are predominantly large corporations, while smaller borrowers in international markets are typically from advanced economies.

In sum, the percentage of firms using long-term debt markets is smaller in emerging markets (see Chart 8.1). Smaller firms in these economies continue to rely, at least for the time being, on shorter-term instruments such as commercial paper or traditional bank loans.

1 See also Eichengreen et al. (2015).
2 Balgova et al. (2017).
3 See Cortina et al. (2017).
4 See De Haas and van Horn (2017).
FINANCE AND THE ENVIRONMENTAL KUZNETS CURVE

The structure of the financial system also has an impact on the amount of environmental pollution that accompanies the middle-income transition. As discussed earlier, pollution increases in early stages of development, but will decline once a country surpasses a certain income level, in accordance with the environmental Kuznets curve. As a result, pollution can be at its worst when countries reach middle-income status. Two mechanisms underpin the environmental Kuznets curve hypothesis. First, in the early stages of development, a move from agriculture to manufacturing and heavy industry is associated with higher income and more pollution per capita (see Charts 8.3 and 8.4). Second, at some point, the structure of the economy moves towards light industry and services (see Chart 8.5) and the shift is accompanied by a levelling off of pollution, and in some cases a reduction in the amount of pollution per capita.

In addition to sectoral shifts, the adoption of more advanced technologies can substitute clean production methods for dirty ones and reduce pollution per unit of output in a given sector.

A logical question, therefore, is whether finance has an impact on the two main mechanisms underpinning the environmental Kuznets curve: a shift towards less polluting sectors and an innovation-driven reduction in sectoral pollution? Are well-developed banking sectors and stock markets detrimental to the environment, as they fuel consumption growth and the concomitant emission of pollutants? Or can financial development steer economies towards more sustainable growth by favouring clean industries over dirty ones?

Recent research has started to disentangle this nexus between finance, growth and pollution, as proxied by the emission of CO₂. A move towards green technologies in middle-income economies can require substantial investment. Such investments are dependent on the availability of external finance. Schumpeterian growth models suggest that financial constraints can prevent firms in less-developed countries from exploiting research and development carried out in countries closer to the technological frontier. Financial development can thus facilitate the adoption of state-of-the art technologies and help mitigate environmental pollution. But what kind of financial development?

Do banks or stock markets do a better job of enabling green investment? For a variety of reasons, banks may be less suited to financing projects that reduce industrial pollution. First, banks are

CHART 8.2. Long-term debt issuers are more prevalent in higher-income countries

CHART 8.3. Agricultural share of total value added declines as per capita income rises

Source: Cortina et al. (2017).
Note: Long-term debt issuers are firms that issued at least one bond or syndicated loan between 2003 and 2011.

Source: World Bank and authors’ calculations.

DO BANKS OR STOCK MARKETS DO A BETTER JOB OF ENABLING GREEN INVESTMENT? FOR A VARIETY OF REASONS, BANKS MAY BE LESS SUITABLE FOR FINANCING PROJECTS THAT REDUCE INDUSTRIAL POLLUTION

See also Grossman and Krueger (1995) and Hettige et al. (2000).

See De Haas and Popov (2018).

See Aghion et al. (2005).
technologically conservative; they tend to fear that funding new technologies (which tend to be cleaner) erodes the value of the collateral underlying existing loans. Such collateral (machinery and equipment or industrial facilities) largely involves old (dirtier) technologies.9 Second, banks can hesitate to finance green technologies if the related innovation involves assets that are intangible, firm-specific and linked to human capital – assets that are harder to value as collateral and more difficult to sell in the event of non-repayment. Third, banks often operate on a shorter time horizon (the loan maturity) than equity investors. They are consequently less interested in whether assets are likely to become less valuable (or even stranded) in the distant future.

In contrast, stock markets may be better suited to financing innovative (and greener) industries. Equity contracts are more appropriate for financing green innovations that are characterised by high risks and high potential returns. Equity investors also tend to pay more attention to future pollution, so stock prices rationally discount the future cash flows of polluting industries. Empirical evidence shows that stock markets, indeed, punish firms that perform badly in environmental terms (for instance, those that have been involved in environmental accidents) and reward firms that are environmentally friendly.9 Ultimately, however, whether banks or stock markets are better suited to limiting or even reducing environmental pollution remains an empirical question.

FINANCE AND POLLUTION: KEY FACTS
Recent research on the relationship between financial development and environmental pollution has uncovered four main empirical facts.10 First, at country level, growing credit markets are associated with higher levels of CO₂ emissions. In sharp contrast, larger stock markets are associated with substantially lower levels of CO₂ emissions. It could, of course, simply be the case that financial development is correlated with general economic development and that the relationship between credit growth and pollution simply reflects a general increase in wealth.

However, the picture remains unchanged even when controlling for GDP per capita, a measure of a country’s level of economic development. As before, deeper credit markets are associated with higher levels of pollution, while more developed stock markets are positive for the environment. In these estimations, carbon emissions start to decline at an annual income of around US$ 40,000. This is in line with earlier estimates by Holtz-Eakin et al. (1995), who find a peak in CO₂ emissions at a per capita GDP of around US$ 35,000.

Second, at sector level, we can compare the impact of financial development on relatively “dirty” versus relatively “clean” sectors. More specifically, pollution intensity can be measured as the amount of CO₂ emissions of a particular industry per unit of value added globally. Industries vary widely in terms of their inherent propensity to pollute (see Chart 8.6). The most polluting industries are energy generation, transport and the manufacturing of basic metals, while the manufacturing of transport equipment and construction are among the least polluting sectors globally.

Using data on industries’ inherent tendency to pollute, one can test whether technologically dirty sectors produce higher CO₂ emissions than technologically clean sectors in countries with growing financial markets. Such an analysis reveals that industries that pollute relatively more for inherent, technological reasons generate relatively higher CO₂ emissions in countries with expanding credit markets. Importantly, stock markets have the exact opposite effect: industries that pollute relatively more for technology-related reasons produce relatively lower CO₂ emissions in countries with deepening stock markets.

Third, there are two main channels underpinning this relationship between financial development and environmental pollution. The first is cross-industry reallocation, whereby (holding technology constant) stock markets reallocate investment towards relatively clean industrial sectors while credit markets promote a reallocation of investment towards dirtier sectors. Another channel is intra-industry technological innovation, whereby (holding the industrial structure constant) industries adopt more efficient, cleaner technologies over time. Here, the data reveal declining levels of intra-industry technological innovation as credit markets develop. In particular, in countries with growing credit markets, dirty sectors post higher levels of CO₂ emissions per unit of value added than clean sectors. In countries with deepening stock markets, we see the opposite effect: pollution levels per unit of value added decline more in dirty sectors than in clean ones.

Fourth, greater green innovation in the dirtiest industries driven by stock-market development is reflected in patenting data. Background analysis shows that patenting activity in technologically dirty industries declines with credit-market development. This is the case both for total patents and for various green patent aggregates. At the same time, however, the number of green patents per capita increases faster in technologically dirty industries when stock markets grow. These results complement those of Hsu et al. (2014), which show that high-tech industries that depend on external finance are less likely to file patents in countries with better-developed credit markets and more likely to file patents in countries with better-developed stock markets. In sum, the ability of polluting industries to become greener through innovation depends on the relative development of credit and equity markets.

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9 See Minetti (2011).
9 See Klassen and McLaughlin (1996).
10 See De Haas and Popov (2018).
THE ABILITY OF POLLUTING INDUSTRIES TO BECOME GREENER THROUGH INNOVATION DEPENDS ON THE RELATIVE DEVELOPMENT OF CREDIT AND EQUITY MARKETS

DEEPER CREDIT MARKETS ARE ASSOCIATED WITH HIGHER LEVELS OF POLLUTION, WHILE MORE DEVELOPED STOCK MARKETS ARE POSITIVE FOR THE ENVIRONMENT
POLICY IMPLICATIONS

Recent research shows that financial development is, to a large extent, responsible for the inverse U-shape of the environmental Kuznets curve. Stock-market development strongly lags credit-market development over time (see Chart 8.7). The growth of credit markets is more gradual, while stock markets are prone to steep booms and busts. Stock-market capitalisation as a percentage of GDP has only overtaken credit (also expressed as a percentage of GDP) for brief periods: during the dotcom bubble of the 1990s and in the run-up to the global financial crisis of 2008-09. Because stock markets only catch up with credit markets at later stages of development, the pattern of financial development reinforces the non-linear relationship between economic development and environmental quality.

From a public policy perspective, this suggests that countries with bank-based financial systems that aim to “green” their economies by promoting green bonds or other green-finance initiatives should consider stimulating the development of conventional equity markets as well. This is particularly true for middle-income countries where CO₂ emissions tend to be highest and stock markets may remain relatively underdeveloped.

In parallel, countries can take measures to offset the continued tendency of credit markets to finance relatively dirty industries. For example, the green credit guidelines and resolutions that China and Brazil introduced in 2012 and 2014, respectively, encourage banks to improve their environmental and social performance and lend more to firms that are part of the low-carbon economy.

From a financial-industry perspective, adherence to risk-management frameworks that take green economy issues into account — for example, the Carbon Principles,¹¹ Climate Principles¹² and Equator Principles¹³ — should also contribute to a gradual “greening” of bank lending. Strict adherence to these principles could also make national climate-change policies more effective by accelerating the reallocation of capital and investment towards lower-carbon technologies.

¹¹ The Carbon Principles are guidelines established by Citigroup Inc., JP Morgan Chase and Morgan Stanley for assessing the climate-change risks associated with power-generating financing.

¹² The Climate Principles set out a framework for reducing climate-change risks and the carbon footprint of the financial sector.

¹³ The Equator Principles provide a risk-management framework for financial institutions to determine, assess and manage environmental and social risk in project finance.