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Seven Questions about Climate Change¹

Rabah Arezki and Akito Matsumoto



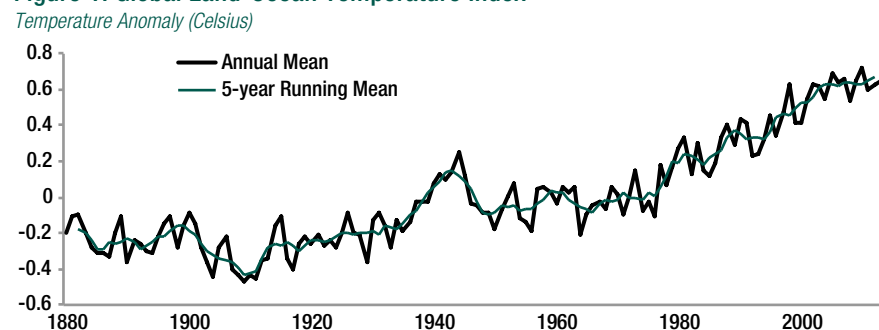
Climate change is at the top of the agenda of policymakers as they gather in Paris for the United Nations Climate Change Conference, COP21. Climate change is a threat to the very survival of humanity. Notwithstanding the severity of the threat, actions to halt climate change have been scant and uneven across countries. This Q&A article provides brief answers to seven questions about climate change, its consequences, and the coordination for developing mitigation strategies.

Question 1. What is climate change?

Climate change refers to changes in the patterns of the overall climate of the Earth. It can refer to changes in the Earth's average temperature and precipitation patterns. Among them, the gradual increase in the average temperature of the Earth's atmosphere and its oceans is often referred to as global warming (see Figure 1), and the potential causes and consequences from global warming have been the main focus of many discussions.

Some causes of climate change are natural. These include changes in the Earth's orbit and in the amount of energy coming from the sun. Volcanic eruptions are also natural causes of climate change. There is, however, a consensus among scientists that recent global warming cannot be explained by nature alone.

Figure 1. Global Land-Ocean Temperature Index



¹ We are grateful to Maury Obstfeld for insightful comments and suggestions.

Human activity is another source of climate change. Most scientists argue that global warming since the mid-nineteenth century is mostly due to the combustion of fossil fuels (coal, oil, and natural gas) that constitute today’s major sources of energy for the global economy. The burning of these fossil fuels releases greenhouse gases, such as carbon dioxide, into the air.²

Question 2. Is there evidence of global warming?

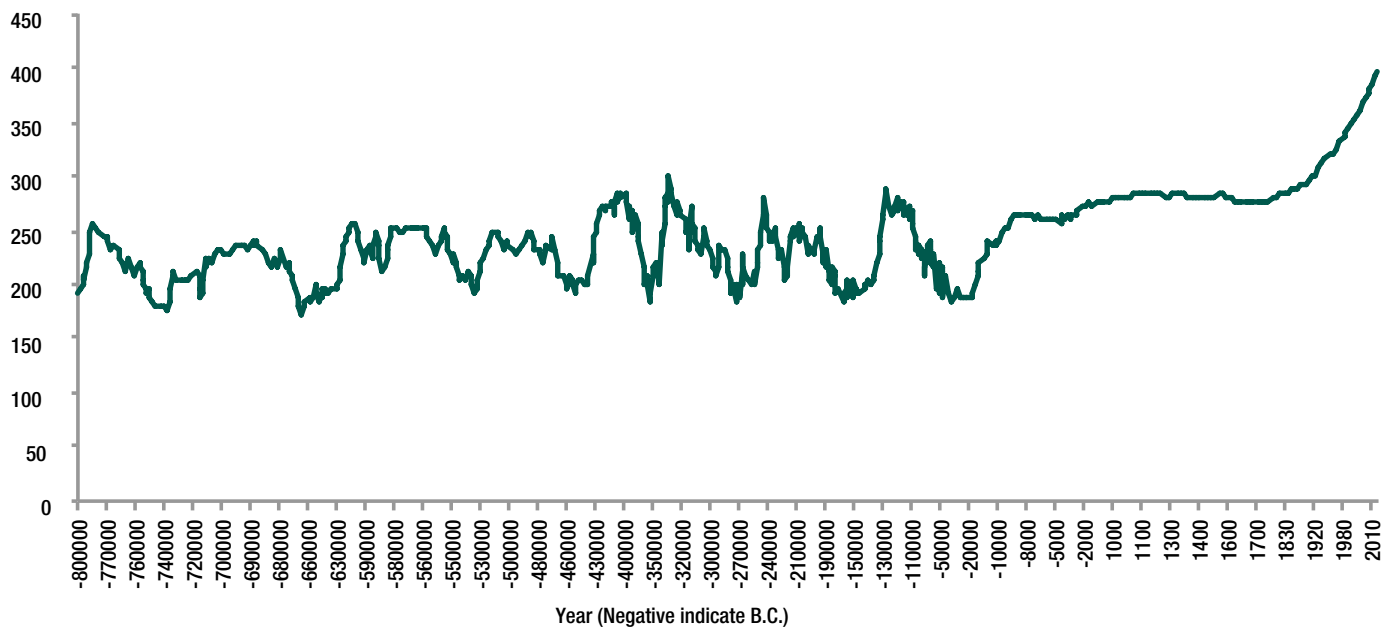
The average temperature of the Earth has risen by a little more than one degree Fahrenheit over the past 100 years or so. It may not seem like much, but small changes in the Earth’s average temperature can lead to big consequences. The Intergovernmental Panel on Climate Change’s (IPCC) Fifth Assessment Report concludes, that “the human influence on the climate system is clear and is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system.”

There is a strong scientific consensus that the global climate is changing and that human activity contributes significantly to this trend. According to Cook and others (2013), 97 percent or more of climate scientists agree that this is due to human activity—notably, emissions of carbon dioxide.

Considering that carbon emissions are chiefly caused by the burning of fossil fuels following the industrial revolution, human activity is seen as playing a key role in global warming. Scientists find that around 1950, carbon dioxide levels in the atmosphere reached its highest point in 650,000 years and has been increasing with dramatic speed since then (see Figure 2). The carbon lifecycle and deforestation have made it harder to resorb carbon dioxide. Oceans absorb carbon dioxide and this in turn leads to acidification. Changes in the ocean’s ecology then destroys coral reef habitats.

Figure 2. Estimates of CO₂ Emissions

Parts per million (ppm) of CO₂



Source: EPA’s Climate Change Indicators in the United States: www.epa.gov/climatechange/indicators

² Outside carbon dioxide, greenhouse gases are methane—more potent at warming but degrades faster than carbon dioxide—water vapor, nitrous oxide, and ozone.

Question 3. What are the economic and social consequences of global warming?

Global warming can cause climatic catastrophes. Global warming leads to rising sea levels, melting of glaciers, and ice sheets; and these changes, in turn, affect precipitation patterns. The severity and frequency of hurricanes and storms also increase as a result. These catastrophes include irreversible events. For example, permafrost melting allows previously frozen organic matter to release potentially large amounts of methane.

The social consequences of global warming can be dramatic. While air pollution associated with the use of coal and oil has consequences on the immediate health and well-being of individuals, the resulting global warming can affect human and animal livelihoods by endangering and even destroying their habitat.³ Global warming can thus trigger famines, mass movement of populations, and endanger animal species directly; and it can also alter the balance of ecosystems indirectly.

Global warming disproportionately affects vulnerable groups and certain territories. For example, islands and coastal areas are the most threatened loci because of rising sea-levels. Individuals living in rural areas in poor countries are also disproportionately affected by climate change because they are more reliant on natural resources and the environment for their subsistence (see e.g., World Bank, 2011).

Climate change and global warming reduces economic growth and slows economic activity in different ways.⁴ For example, global warming can affect agriculture in two ways. First, it can destroy agricultural harvests. Second, it can also affect agricultural productivity permanently. Beyond agriculture, global warming can damage infrastructure, raise health costs and insurance premia, and cause financial stress. The disorder caused by socioeconomic tensions, including mass migration and conflicts, resulting from global warming can also deter foreign investment, and, hence, reduce growth.

³ It could even affect the ecosystem in oceans, which absorb CO₂ and emit oxygen through phytoplankton activities. One study claims that beyond a certain threshold the earth will suffer from a shortage of oxygen.

⁴ The cross-correlation between temperature and income is negative and well known often invoking weather as key explanation behind development outcomes. In addition, Dell, Jones, and Olken (2012) show that countries tend to grow more slowly in a warm year compared to a cold year. Burke and others (2015) provide evidence that the relationship between temperature and economic outcomes is in fact non-linear.

Question 4. What can be done to mitigate global warming?

As the world's leaders meet in Paris for the COP21 (the 2015 Paris Climate Conference), they aim to reach a new international agreement on the climate, applicable to all countries, with the aim of keeping global warming below 2 degrees Celsius. To do so, greenhouse emissions need to be limited—in particular, carbon dioxide. Notwithstanding the uncertainty regarding the costs and benefits associated with global warming, the irreversible consequences of the latter call for urgent action.

At the intensive margin, the reduction of fossil fuel consumption can be achieved through significant improvements in the energy efficiency of existing technology or active awareness campaigns regarding the consequences of greenhouse emissions. The capture and sequestration of carbon dioxide can also limit emissions—that is, however, too expensive to be viable at this point. At the extensive margin, shifting away from fossil fuels to clean, renewable energy resources (hydro, solar, wind, and geothermal) or nuclear energy can significantly reduce emissions. Also the possibility of shifting from coal to gas in electricity generation can significantly help reduce emissions. This is a linchpin of the U.S. Clean Power Plan.

Many governments have set voluntary targets to limit greenhouse emissions. However, the setting of a particular target may not be optimal. Instead, the price of fossil fuels should reflect the externality that the consumption of the latter exerts on the environment. The price of carbon should equal the social cost of carbon, which is the present discounted value of marginal global warming damages to production of burning one ton of carbon today. By making fossil fuels cheaper as an input, the current low price environment may stimulate their use and thereby discourage the development of alternative energy sources (see Arezki and Obstfeld, 2015). Interestingly, the so-called “shale gas revolution” in the United States has significantly reduced the use of coal in the United States on account of historically low natural gas prices, in turn displacing coal to Europe where coal is increasingly being used for electricity generation.

Absent any mitigation effort, countries will have to adapt to global warming. Adaptation consists in simply adjusting to the new reality of global warming. It would lead to population displacements from exposed areas or adapting infrastructure and housing to new climatic risks. But adaptation alone is neither fully acceptable nor sufficient considering that global warming can cause irreversible

damage. For instance, some ecosystems cannot adapt to rising temperatures and subsequently, this will reduce bio-diversity.

Question 5. What is the “energy transition”?

The energy transition is the shift toward a de-carbonized energy consumption. Among primary energy sources, renewables are the least carbon intensive, and among fossil fuels natural gas generates the least emissions. Nuclear energy is also a source of energy with limited carbon emissions, but several countries have imposed moratoria on account of the perceived environment liabilities. One of the most notable trends in energy consumption is the increase in the use of renewable energy resources. The International Energy Agency expects that the share of renewables in global total primary energy consumption will increase from 14 percent in 2013 to 19 percent in 2040, when considering the expected energy policy changes. One of the most affected sectors will be the electric power sector where the share of renewables is expected to increase from 22 percent to 34 percent over the same period.

Natural gas may provide a “bridge” toward renewables. Considering its relatively clean nature and its relative abundance, natural gas may indeed play a key role in the

transition period from coal to renewables. The U.S. shale gas production is expected to grow, which will make natural gas the energy of choice. There is also potential for a growth in the sale of shale gas and conventional natural gas in China and many other countries around the globe.

Question 6. Who are the biggest emitters of greenhouse gases?

Any effort to address global warming should involve the largest economies. Large economies tend to be the biggest emitters of greenhouse gases. Indeed, the 10 largest emitters are responsible for over sixty percent of global emissions (see Table 1).

Emerging markets will continue to drive the growth of future emissions. While high income countries are big emitters in per capita terms, energy efficiency has been gaining ground in these countries. One should expect consumption of fossil fuels by advanced economies to continue to decrease. Whereas, emerging markets and developing countries are still heavily reliant on coal and their consumption of fossil fuels will continue to rise. Coal is a major source of emissions, especially in the presence of low efficiency coal plants. Coal is used in electricity generation and currently it is quite cheap. Beside carbon dioxide, old

Table 1. Global Share of Greenhouse Gas Emissions by Country

CO₂ emissions – fuel combustion, 2013

Country	share (of global)	CO ₂ / Population (tCO ₂ per capita)	CO ₂ / GDP PPP (kgCO ₂ per current international \$)	GDP per capita (current PPP)
China	28%	6.65	0.55	12,196
United States	16%	16.18	0.31	52,980
India	6%	1.49	0.28	5,418
Russian Federation	5%	10.75	0.43	25,033
Japan	4%	9.70	0.27	36,223
Germany	2%	9.42	0.21	43,887
Korea	2%	11.39	0.34	33,089
Canada	2%	15.25	0.35	43,033
Islamic Republic of Iran	2%	6.79	0.42	16,067
Saudi Arabia	1%	16.39	0.31	52,993
Total share (10 top countries)	67%			

Source: International Energy Agency; World Bank, World Development Indicators; and IMF staff calculations.

plants tend to emit more air pollutants such as nitrogen oxides and sulfur oxides.

While China, the world largest coal consumer, is shifting toward use of renewable energy resources, demand from other developing countries, especially from India, is expected to increase especially if coal prices stay low. If these countries do not adopt state of the art technology for coal-powered plants, global emissions will reach dramatic levels and in turn accelerate global warming. Poorly designed regulations in the use of coal in developing countries could also discourage technological change in the electrical power sector. As a result, the world might not benefit from the downward trend in coal usage in developed countries.

Question 7: Why is it difficult to coordinate over the mitigation of climate change?

Considering that carbon emissions involve an externality, government intervention is warranted to avoid the free riding problem. The global nature of the issue thus requires international coordination. In theory, a global carbon tax would be the most efficient way to reduce emissions. The Kyoto protocol, a treaty aimed at reducing carbon dioxide emissions, was adopted in 1997, but a few major countries, such as the United States, India, and China, did not commit to legally binding targets. The Copenhagen Climate Conference did not yield any agreement and postponed any activity till the 2015 Paris Conference.

Governments have been asked to submit their Intended Nationally Determined Contributions (INDCs). INDCs are not legally binding, but rather an individual government's non-legal commitment to slow global warming. During the conference, authorities might strike a deal to make these commitments binding to some degree.

For low-income countries in particular, development aid may be necessary to facilitate the import of clean technology that will ensure that they participate in the energy transition. This would reduce their transitional costs from removing carbon subsidies and levying positive carbon taxes. The Green Climate Fund is a fund within the framework of the United Nations founded as a mechanism to assist developing countries in adaptation and mitigation practices to counter climate change. It is intended to be the centerpiece of efforts to raise Climate Finance to \$100 billion a year by 2020.

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Research Summary

Winning the Oil Lottery: The Impact of Natural Resource Extraction on Growth

Tiago Cavalcanti, Daniel Da Mata, and Frederik Toscani

This summary provides evidence of the causal impact of oil discoveries on development. Novel data on the drilling of 20,000 oil wells in Brazil allows us to exploit a quasi-experiment. Municipalities where oil was discovered constitute the treatment group, while municipalities with drilling but no discovery are the control group. The results show that oil discoveries significantly increase per capita GDP and urbanization. We find positive spillovers to non-oil sectors, specifically, an increase in services GDP which stems from higher output per worker. The results are consistent with greater local demand for non-tradable services driven by highly paid oil workers.

What are the effects of oil discoveries on economic development? Although there is a long tradition in economics of studying the impact of natural resource abundance, no clear consensus has emerged in the literature. Should the discovery of oil lead to a prosperous period of high growth in both the short and long run or should countries fear the much-discussed Dutch disease? Nominal exchange rate appreciation and rent seeking can have adverse effects, as can volatility of revenues, but the large fiscal windfall associated with resource revenue can also foster development. Even when we abstract from nominal exchange rate movements and the impact of oil rents, the pure effect of the physical presence of a natural resource sector might drive up local prices—and therefore crowd out the development of other economic activities, bringing about negative effects on growth—or increase demand for workers and attract new activities, which can lead to agglomeration effects, with a positive impact on productivity and income (Michaels, 2011).

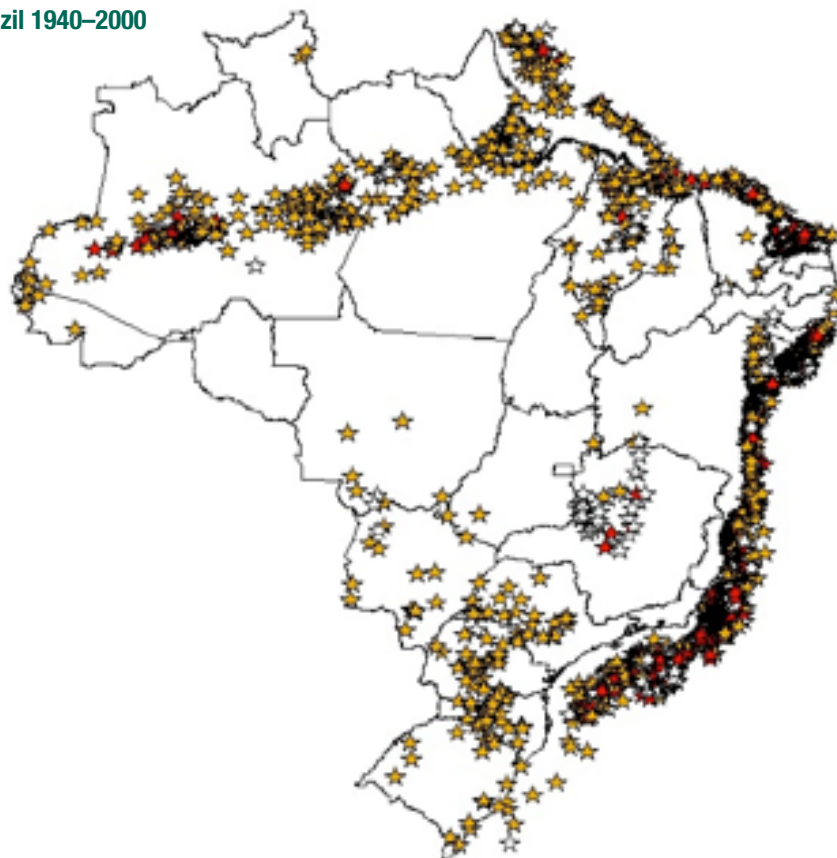
Initially, the literature focused on finding aggregate, country-level evidence of the overall impact of natural resource abundance. However, cross-country evidence was shown to be sensitive to changing periods, sample sizes, and covariates (for an overview of the literature, see van der Ploeg, 2011). To try to disentangle the various mechanisms through which natural resource production can affect development in more

detail, a strand of the literature to which we contribute has shifted to within-country studies (Acemoglu and others, 2014; Dube and Vargas, 2013; and Michaels, 2011). Recent evidence indicates, however, that resource extraction is endogenous to institutions (Cust and Harding, 2014; and Arezki and others, 2015). These results indicate that places with better institutions discover more natural resources and that a simple regression of resource extraction on development indicators is thus likely to be biased and indeed overestimate the impact of resource extraction.

In order to overcome these concerns, we use the random outcomes of exploratory oil drilling in Brazil to investigate the causal effect of natural resource discoveries on local development. Specifically, we compare economic outcomes in municipalities where the national oil company, Petrobras, drilled for oil, but did not find any, to outcomes in those municipalities in which it drilled for oil and was successful. Drilling attempts were carried out in many locations with similar geological characteristics, but oil was found in only a few places. The “treatment assignment” is related to the success of drilling attempts: Places where oil was found were assigned to treatment, while places with no oil are part of the control group. The treatment assignment resembles a “randomization,” since (conditional on drilling taking place) a discovery depends mainly on luck (see Figure 1 for a map of all dry and discovery wells). Therefore, places with oil discoveries are the “winners” of the “geological lottery.” Since there were no significant royalty payments to municipalities in Brazil until several decades after the first discoveries, we are able to isolate the direct impact of oil extraction from the effect of fiscal windfalls. And since we are conducting a within-country study, there cannot be any nominal exchange rate response by construction.

The baseline results show that locations in which oil was discovered had a 24.6–25.9 percent higher per capita GDP over a span of up to 60 years compared to those in the control group (see Table 1). Furthermore, we document an increase in both manufacturing and services GDP per

Figure 1: Oil Wells Brazil 1940–2000



(Note: Dry wells in yellow, discovery wells in red.)

Source: Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (ANP)

Table 1: The Impact of Oil Discoveries on Local Socio-Economic Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	In Population Density	In GDP per capita	Urbanization rate	Manufacturing GDP per capita	Services GDP per capita	Agriculture GDP per capita
Discovery Dummy	-0.0127 (0.0731)	0.259*** (0.0910)	0.0430** (0.0213)	0.456** (0.189)	0.215** (0.104)	0.0664 (0.109)
MCA FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,024	768	1,024	765	764	765
Number of MCAs	128	128	128	128	128	128
Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes
Initial Conditions	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	FE	FE	FE	FE	FE	FE

Note: Standard errors clustered at the MCA level. Geographical controls and initial conditions have time-varying coefficients. Source: Authors' calculations.

(continued on page 8)

capita, but no impact on agricultural GDP. While the measure of manufacturing GDP includes natural resource extraction (and as such an increase is not surprising), the increase in services indicates that the spillover effects of oil production impact the rest of the economy. Additionally, we find evidence for an increase in urbanization of about 4 percentage points. This increase in urbanization is consistent with the increase in services we document. We do not find any effect on population density.

Using historical data on sectoral employment, we calculate a measure of sectoral output per worker and find that oil discoveries increase GDP mainly by increasing output per worker. While both onshore and offshore discoveries increase manufacturing GDP (potentially in a mechanical way, since manufacturing includes oil production), only onshore discoveries increase services GDP and urbanization. We hypothesize that demand from well-paid oil workers is responsible for the observed increase in services and urbanization. Oil municipalities become local service and commerce hubs which benefit from improved output per worker.

In order to shed light on whether our results are mainly driven by local price effects or real changes in the economy, we look at recent microdata from the Brazilian employment and population censuses. We find that municipalities in which oil was discovered have larger services firms, a higher density of formal services workers, and a lower fraction of workers employed in the subsistence agricultural sector than the control group. The move from rural informal work to the formal services sector explains the observed increase in urbanization and services GDP per capita. We also show that wages in the services sector adjust upwards. Consequently, we find evidence for both nominal and real effects. Lastly, the density of non-oil manufacturing firms and workers is not affected by oil discoveries.

Our findings, therefore, do not provide support for either the deindustrialization hypothesis of natural resource discoveries or

positive agglomeration effects in the manufacturing sector, but they show that oil production has important real effects on the local economy and, in particular, on the services sector. Since in our setting there are no nominal exchange rate effects and no rents accrue to the municipalities, our results can be viewed more generally as testing for the impact of an investment and consumption shock in mostly rural municipalities.

It is important to stress, however, that we cannot make inference on the aggregate impact of oil discoveries on the country as a whole. Compared to national economies, municipalities are much more open and face macroeconomic policies which are invariant to their idiosyncratic conditions.

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Research Summary

Malaysia: Achieving High-Income Status through Resilience and Inclusive Growth¹

By Alex Mourmouras and Niamh Sheridan



Malaysia's economic performance since its independence in 1957 has been strong. It is now an upper-middle income economy whose income per capita has grown 20-fold

over the past 40 years. Economic growth has been inclusive, with the share of households living below the national poverty line falling from over 50 percent in the 1960s to less than 1 percent currently. Natural resource wealth has been well-managed and widely shared; inflation has been stable, and a strong financial sector has been developed that is at the center of global Islamic finance. Despite facing significant shocks, the Malaysian economy has shown remarkable resilience, and has recovered quickly from the Asian financial crisis and from the global financial crisis. The reform process is ongoing with the aim to achieve high-income status by 2020.

Successful Structural Transformation

Malaysia's transformation was achieved through a wide range of structural reforms throughout the last four decades, with continuous reform efforts to support growth, boost productivity, and strengthen resilience. To gain a systematic understanding of the stages of structural reforms in Malaysia we follow the classification of the stages of structural reforms adopted in recent IMF research (IMF Board paper on structural reforms, IMF 2015). The main insight is that the reform agenda evolves as economies develop: each stage of development brings its own reform challenges. The payoff in terms of higher productivity also evolves through time. Governments need to prioritize reform areas depending on the level of development in their country.

¹ This article summarizes the main conclusions from a forthcoming book, "Malaysia: Achieving High Income Status through Resilience and Inclusive Growth," edited by Alex Mourmouras and Niamh Sheridan, with contributing authors from various departments within the IMF, the World Bank, American University, and Malaysian government agencies.

The focus of reforms in the 1960s and 1970s was on tackling Malaysia's extensive rural poverty and upgrading its undiversified agriculture- and natural resource extraction-based economy. Various government programs aimed to increase productivity and eradicate rural poverty, for example, a land settlement scheme provided poor farmers with rights to the land; and sizable resources were channeled to improve agricultural infrastructure (irrigation and drainage systems). Agricultural extension and support services were provided in rural areas, and government supported research and development in high-yielding agricultural products. These reforms paid off: improvements in agriculture productivity contributed to the reduction of poverty and income disparities.

The release of surplus rural labor helped to lay the foundation for industrialization. Malaysia followed a public sector-led development strategy during the 1970s. Public investment and the state-owned enterprise (SOE) sector both grew significantly. Higher public outlays boosted economic growth to around 8 percent and reduced poverty from about 50 percent in 1970 to 37 percent by 1980, but also led to double-digit fiscal deficits and record high public debt in the early 1980s. This coupled with a downturn in external demand and a fall in the prices of Malaysia's major primary export commodities, resulted in a sharp recession in 1985. In response to the recession, the authorities launched far-reaching structural reforms in the mid-1980s aiming to revitalize the private sector and restore macroeconomic stability.

The next stage of reforms, from the mid-1980s to the mid-1990s, focused on trade, financial liberalization, and infrastructure. Trade liberalization was greatly accelerated when Malaysia adopted an outward-oriented development strategy in the 1980s. Import duties on manufactures that had enjoyed extensive tariff protection were dismantled. Industry was deregulated and industrial licensing and ownership rules were relaxed. The capital account was liberalized and tax incentives and targeted allowances for foreign direct investments led to large FDI inflows into the

manufacturing sector. The structural transformation was substantially underway.

The upgrading of infrastructure was an important component of the transformation. Public spending in the transport and power sectors was increased. Other infrastructure sectors were privatized. Private investments in telecommunications, for instance, helped with the infrastructure push. Economic diversification coupled with financial deregulation and liberalization helped spur the banking system and develop capital markets. Collectively, these reforms transformed Malaysia into an upper middle-income country by the mid 1990s. However, the rapid pace of financial liberalization and deregulations, combined with a pegged exchange rate system also brought a surge of speculative capital inflows, increasing vulnerability in the financial sector.

Fiscal reforms played an important role during this reform phase. The government initiated a comprehensive fiscal structural adjustment program, with large-scale expenditure cuts in the public sector and institutional reforms in the budget process. Tax reforms sought to lower the tax burden and incentivize private investment. A sound resource wealth management framework, with natural resource rents being invested in productive capital and saved abroad rather than being consumed, further contributed to productivity growth and macroeconomic stability.

Structural reforms, coupled with prudent macroeconomic policies help restore fiscal sustainability and put the economy back to a rapid growth trajectory led by the private sector. As a result, the overall budget deficit dropped from 10.5 percent of GDP in 1986 to a near balanced budget in the 1990s. Private investment surged from 14 percent in 1986 to 32 percent of GDP in 1997, and growth averaged around 8 percent over the same period.

The strong economic performance continued until the 1997–98 Asian financial crisis, which left Malaysia reeling from a severe currency and banking crisis, large depreciation, and massive capital flight. Austerity measures, including a significant interest rate increase and public expenditure cuts, were adopted at the beginning of the crisis with views to stem capital outflows and depreciation. As the economic downturn became more pronounced, policies shifted during the second half of 1998 with a view to supporting aggregate demand through monetary easing and fiscal stimulus.

Around the same time, a new round of structural reforms was also adopted as a package of the National Economic Recovery

Plan to address the crisis legacy of slow growth and a weak financial system. These reform measures were implemented in stages throughout the late 1990s and the 2000s, including temporary controls on capital flows and fundamental reforms in the financial sector. Capital and currency controls on short-term portfolio flows were adopted during the crisis to reduce volatility, while these controls gradually eased as recovery took place. From 2005 onward, the exchange rate and capital flow policies became almost fully liberalized. More fundamental reforms were undertaken in financial and corporate sectors, including upgrading regulation and supervision in line with international best practices. Banking groups were strengthened and consolidated, and foreign entry was allowed to enhance competition. Equally important were reforms to develop and diversify the capital markets, including liberalization to allow foreign corporations to raise funding. These measures together helped to create a deep and liquid financial system that is more resilient, relying more on the market rather than credit financing. Reforms were also taken to improve the business regulatory environment, firmly placing Malaysia in the top 25 countries for the ease of doing business.

With the aim of reaching high income status by 2020, Malaysia launched in 2010 a new generation of reforms targeting private sector led growth by moving into higher value-added activities in both industries and services. These reforms include transforming industrial policies into innovation and technology policies, improving the quality of infrastructure and addressing labor skills shortages and mismatches. Substantial progress has been made in raising school enrollment, though challenges remain in further improving the quality of education. Social protection was also improved by introducing the minimum wage in early 2013.

Avoiding the Resource Curse

Malaysia's economic success was underpinned by successful management of its natural resource revenues. Resource rents were channelled into increases in productive capital, infrastructure, and human capital, which in turn supported economic diversification and encouraged innovation. Agricultural and other sectoral policies helped deliver inclusive growth ensuring the benefits were widely shared. The Malaysian experience with successful management of natural resource wealth offers lessons for other economies in avoiding the so-called natural resource curse.

Hartwick (1978) suggested a “rule of thumb” that serves as a guideline for managing finite natural resource wealth

so as to ensure sustainability of income and consumption growth. Hartwick's rule states that the optimal level of consumption can be sustained if the value of net investment equals the value of rents extracted at each point in time. Research by the World Bank (2011) showed that between 1970 and 2005 very few resource rich countries followed this rule, including no countries with resource rents in excess of 15 percent of GDP. Malaysia, however, was one of a just a few countries (along with Indonesia and China) with resource rents above 10 percent of GDP that followed the Hartwick rule and invested rather than consumed their natural resource rents.

The Malaysian economy is well-diversified and Malaysia's exports include high value-added commodity products along with high-tech manufactured goods as part of the Asian supply chain. This contrasts with the largely agricultural and commodity-based economy at independence. The government actively sought to diversify its manufacturing sector, beginning in the early 1980s with policies to attract foreign direct investment and encourage private-sector led growth. In addition, industrial policies including significant tax incentives and in some cases tariff protection help boost both domestic and foreign investments in manufacturing industries. To a great extent, these efforts have been successful: the economy has diversified both horizontally and vertically and the diversity and sophistication of manufacturing and exports has increased. Malaysia's diversification is helping to shield the economy from the impact of the decline in oil prices at the end of 2014.

The state-owned oil company PETRONAS has played an important role in managing resource wealth. Although not a sovereign wealth fund, PETRONAS has played a similar role by facilitating cross generational sharing of resource wealth, buffering the federal budget from shocks and helping to stabilize capital flows. PETRONAS made significant investments in upstream and downstream activities that facilitated vertical integration of the economy. Furthermore, recognizing the limited domestic hydrocarbon reserves, overseas investments by PERTRONAS have ended the lifespan on Malaysia's resource wealth. Not all revenue was repatriated back to Malaysia helping to insulate the economy from excessive capital inflows and exchange rate appreciations during resource booms.

The New Economic Policy (NEP) in 1970 aimed to eradicate poverty and achieve a more equitable distribution of wealth and remove the association between race and economic activity that was undermining stability in the

fledgling nation. Efforts were focussed on supporting education and creating employment opportunities for poorer households and were successful in reducing poverty, in addition to facilitating political stability, which enhanced the business climate.

Securing Macroeconomic Stability after the Asian Financial Crisis

Malaysia's macroeconomic policies have also contributed to its resilience.

Malaysia has experienced four decades of low and stable inflation—an enviable record among emerging market and advanced economies alike. During this period, the Malaysian economy has been buffeted by significant domestic and external shocks; nevertheless inflation has remained in single digits (with the exception of one episode). Since Bank Negara Malaysia's founding in 1959, a key feature has been the continual redesign and reformulation of the monetary policy framework, although at times abrupt, in general, change was more gradualist. The “guided evolution” of the monetary framework reflected a deliberate response to the changing domestic and global macroeconomic environment and the development of the financial sector. A stable real effective exchange rate was supportive of growth and investment through the 1990s as the infant manufacturing sector developed. Since 2005, the exchange rate has become increasingly flexible as post-Asian financial crisis capital controls were gradually unwound, and domestic financial markets and manufacturers became increasingly able to withstand exchange rate fluctuations.

Far-reaching structural and fiscal reforms at the end of the 1980s put the Malaysian economy on a rapid growth trajectory leading up to the Asian financial crisis. Key fiscal initiatives included expenditure-based fiscal consolidation, increased emphasis on infrastructure expenditure to support private sector development, provision of tax incentives for investors, and tariff reduction. These reforms were complemented by comprehensive structural reforms such as industrial deregulation and enhancing the business climate. Altogether, these reforms sought to reduce the role of the state in the economy and lower government's share in GDP and facilitate private sector driven growth. Empirical estimates suggest that these reforms boosted Malaysia's growth substantially (by as much as 2.3 percent per annum on average) compared with a synthetic control group.

Growth, Resilience, and Inclusion: The Role of Finance

Malaysia's financial sector has grown to be sizable (over 400 percent of GDP), is diversified and profitable, and is making an important contribution to growth, resilience, and inclusion. This is underscored by a new financial sector index developed by the IMF that was designed to track three dimensions of a country's financial sector—depth, diversification, and inclusion. (See Sahay and others 2015.) In a cross section of countries, to some extent, financial sector development as measured by this new IMF financial sector index is associated with higher economic growth. Importantly, beyond a critical level, additional financialization of the economy does not pay off. Malaysia happens to be at the sweet spot in development—it is at a level of financial development associated with the highest attainable growth rate.

The first channel through which finance helps in economic development is by lowering the cost of funds in Malaysia and making possible the scaling up of public and private investment. Malaysia's growth in recent years has been driven in large part by a scaling up of private and public investment, and the investment ratio has risen by several percentage points of GDP. Large-scale projects under the Economic Transformation Program (ETP)—a multiyear plan to strengthen Malaysia's economy—are helping to expand and rejuvenate strategic sectors and boost infrastructure for Malaysia's industry and urbanizing society. These programs have helped catalyze private investment which had declined significantly after 1997–98. The country now boasts a modern infrastructure and its business climate has benefitted, as evidenced by high and improving rankings in international indicators of competitiveness.

The scaling up of investment has boosted economic growth in the context of a sluggish post global financial crisis environment. The scaling up of investment has also helped to raise potential growth and to support Malaysia's drive to reach high-income status by 2020. Many of these investments, however, have been debt-financed, raising the question of debt sustainability. Malaysia's deep financial markets have helped to lower its borrowing costs and make them more stable. The nominal ten-year sovereign borrowing rate fluctuates around 4–4.5 percent even in turbulent periods. At close to 2–3 percent, inflation is low and well anchored. Real growth is about 5 percent. With these parameter values, the difference between the real interest rate and the real growth rate ($r-g$) is substantially

negative, between -3.5 and -4, implying favorable dynamics for debt-financed infrastructure. A drive to further improve infrastructure and institutions, including tackling barriers to competition, will prove decisive in Malaysia's quest to escape the middle-income trap and reach high-income status by 2020.

Malaysia has made remarkable progress in increasing access to finance. Further improvements in using financial services require adoption of innovative distribution channels and products that cater to the underserved in a cost-effective way. The regulatory environment is enabling and the market is at a stage of development that permits banks to harness the retail payments infrastructure to invest safely in innovative delivery channels. The development of Islamic finance has also contributed to financial inclusion. The main challenge for Bank Negara Malaysia (BNM) will be to strike a balance between targeted market interventions to advance its developmental agenda and creating market-based incentives for sustainable innovation and healthy competition in retail payments and banking.

Malaysia's highly developed financial sector reflects a concerted, multiyear policy reform effort. The Asian crisis exposed weaknesses in Malaysia's financial system, including over-reliance on bank credit and a fragmented banking system dominated by small, weak institutions. In response, BNM focused its efforts on strengthening and consolidating domestic banking groups. It allowed foreign entry into the domestic banking system to enhance competition. In recent years, Malaysian banks have been expanding in ASEAN, helping to promote the region's integration. A second hallmark of the reform effort was to develop and diversify Malaysia's capital markets. Deep and liquid domestic currency equity and bond markets were nurtured with high levels of domestic and foreign institutional investor participation. The bond market has doubled over the past 10 years to over 100 percent of GDP. Financial supervision and regulation are coordinated and proactive, striking a balance between tighter regulation, including system-wide surveillance to ensure financial stability, and liberalizing remaining financial restrictions. Market discipline was enhanced by strengthening mechanisms for resolving distressed financial institutions and strengthening corporate governance to enhance risk management, self-regulation, and market-discipline.

These efforts have delivered important macroeconomic results in terms of growth, resilience, and inclusion. Malaysia's banks were resilient during the global financial crisis; and deep financial markets and the role of deep-pocketed domestic

institutional investors helped insulate the domestic real economy from foreign financial market volatility.

More importantly, Malaysia's deep financial markets have enabled Malaysia to borrow on its own currency for infrastructure investment—avoiding original sin—which has also helped to boost productivity growth.

Escaping the Middle-Income Trap

Malaysia's reform agenda remains ambitious with many and is aimed at reaching high income status by 2020 (defined as GDP per capita above US\$15,000). This ambitious target serves as a focus for the structural reform agenda. Few countries have succeeded in moving from middle-income to high-income status and while Malaysia is on track to meet its goal by 2020, more reforms will be needed to achieve this objective. The 11th Malaysia Plan appropriately focuses on boosting innovation to drive higher productivity growth. Empirical analysis on the sources of growth shows that total factor productivity growth has lagged behind other countries and had even declined over the last decade.

Surmounting this challenge was the rationale behind the establishment of the Performance Management and Delivery Unit (PEMANDU) in 2009. PEMANDU oversees the implementation of the Government Transformation Program (GTP) and the Economic Transformation Program (ETP). PEMANDU also provides an independent view on performance.

Deep and liquid financial markets are helping Malaysia's economy to become more resilient to external shocks. Malaysia has a relatively high level of federal debt and large foreign holdings of government securities. In recent years, bouts of capital flow volatility have been triggered by asynchronous unwinding of unconventional monetary policies in advanced economies, oil price fluctuations, and other factors. Interest rates have remained low and stable, and financial market conditions have been orderly in the face of sudden and significant portfolio outflows. A flexible policy framework, with exchange rate intervention limited to smoothing volatility and avoiding overshooting, and a strong external position and comfortable foreign exchange reserves, have also contributed to resilience.

Deep pocketed domestic investors like Malaysian banks, the Employee Provident Fund (EPF) and other saving funds, tend to buy significant amounts of domestic equities and government securities during turbulent periods. This helps to stabilize financial markets and shield the real

economy from external volatility, facilitating “financial” (as opposed to “real”) adjustment (see *World Economic Outlook*, October 2013, Chapter 3). Domestic investors enter these markets when foreign investors are selling because of profit opportunities: the prices of Malaysian securities tend to fall and the ringgit depreciates when foreign investors exit and these assets become attractive to domestic investors who have institutional needs for these securities. Nevertheless, caution is warranted: international exposure of domestic institutional investors, estimated at about 20 percent of GDP, is well below that of total foreign ownership of domestic equities and bonds; and, overseas holdings of domestic institutional investors may not be very liquid.

After several years of rapid credit growth, low or negative real interest rates on deposits, and significant increase in leverage, financial risk is rising. Household debt has grown rapidly. Corporate sector debt has also increased and is now close to average for Asia. Banks continue to expand overseas, but their overseas operations are largely funded by local currency deposits, limiting potential funding and exchange rate risks. Malaysian banks do not rely on offshore wholesale funding to fund domestic operations. Balance sheets in Malaysia are strong, providing additional resilience.

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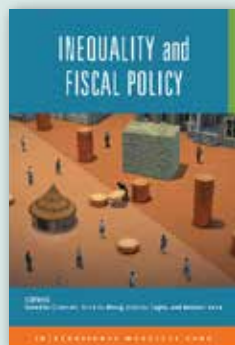
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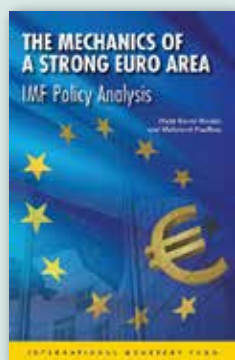
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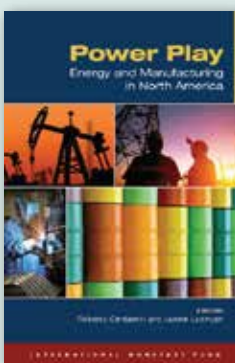
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