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MYANMAR ECONOMIC Bulletin

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Acronyms

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
BOT	Build-Operate-Transfer
BTO	Build-Transfer-Operate
CBM	Central Bank of Myanmar
CLMV	Cambodia, Lao PDR, Myanmar and Vietnam
CPI	Consumer Price Index
CSO	Central Statistical Organization
CS-DRMS	Commonwealth Secretariat Debt Recording and Management System
DACU	Development Assistance Coordination Unit
DICA	Directorate of Investment and Company Administration
DMSP-OLS	Defense Meteorological Satellite Program-Operational Linescan System
DN	Digital Number
ECI	Economic Complexity Index
EU	European Union
EITI	Extractive Industries Transparency Initiative
FDI	Foreign Direct Investment
FIL	Foreign Investment Law
GDP	Gross Domestic Product
GLS	Generalized Least-Squares
GSP	Generalized Scheme Preferences
GSP	Growth and Stability Pact
HS	Harmonized System
GTC	Government Technical College
GTHS	Government Technical High School
GTI	Government Technical Institute
H-P filter	Hodrick-Prescott filter
IMF	International Monetary Fund
ITAS	Integrated Tax Administration System
ITSA	Interrupted Time-Series Analysis
ILO	International Labor Organization

IRD	Internal Revenue Department
JICA	Japan International Cooperation Agency
JV	Joint Venture
LTO	Large Taxpayers Office
MIC	Myanmar Investment Commission
MIL	Myanmar Investment Law
MIMU	Myanmar Information Management Unit
MOPF	Ministry of Planning and Finance
MTDS	Medium Term Debt Management Strategy
MTFF	Medium Term Fiscal Framework
MTOs	Medium Taxpayers Offices
NAIRU	Non-accelerating Inflation Rate of Unemployment
NASA	National Aeronautics and Space Administration
NAWRU	Non-accelerating Wage Rate of Unemployment
NLD	National League for Democracy
NOAA	National Oceanic and Atmosphere Administration
NPT	Nay Pyi Taw
NSSA	National Skill Standards Authority
OAS	Official Assessment System
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Square
PCI	Product Complexity Index
PIP	Public Investment Programme
PFM	Public Financial Management
PPP	Private-Public Partnership
PRRSC	Procurement Rules and Regulations Supervision Committee
RCA	Revealed Comparative Advantage
SAS	Self-Assessment System
SEEs	State Economic Enterprises
SGT	Specific Goods Tax
SDGs	Sustainable Development Goals
SITC	Standard International Trade Classification

STOs	Small Taxpayers Offices
TAPL	Tax Administration Procedure Law
TFP	Total Factor Productivity
TU	Technological University
TVET	Technical and Vocational Education and Training
US	The United States
USD	United States Dollar
WDI	World Development Indicators
WITS	World Integrated Trade Solution

INTRODUCTION AND OVERVIEW

Welcome to the first issue of the Myanmar Economic Bulletin, the flagship publication of the Myanmar Development Institute (MDI). A think-tank established by the notification from the Cabinet of the Government of the Union of Myanmar, MDI aims not just to generate high quality policy research and support the government in the formulation of economic policies, but also to contribute to the formation of a vibrant public sphere in Myanmar in which economic ideas can be articulated and circulated.

The Myanmar Economic Bulletin (MEB) is thus a centrepiece of MDI's mission. MEB will be the forum for high quality research on Myanmar's economy and its dissemination in academic, professional and business circles, and to the public broadly. As broad in focus as the economics discipline itself, MEB will be as wide-ranging in the topics it covers as relevance determines.

Methodologically and ideologically, MEB will likewise be inclusive in its approach. In recent decades economics has become highly mathematical and technique driven, and MEB will not shy away from employing both. Yet, the journal is open to other fields of intellectual endeavour as they are useful, including the insights offered (in a far from exclusive list) through history, psychology, sociology, political science and other disciplines. Ideology has long been a source of contention in economics, but here too MEB is as open as it is plausibly possible to affirm. Indeed, in all of these dimensions MEB is informed by a simple set of criteria: is the issue relevant; is it tractable; can we have something useful to say?

In a typical issue, MEB will contain a mix of articles:

- Long-form analytical pieces that will resemble in rigour, but not in irrelevancy, those typically found in the established academic literature.
- Shorter and more didactic technical and policy briefs. These will still be rigorous, but will engage less in the professional literature, and in important ways will be the vehicles through which younger researchers from MDI and elsewhere might make early-career contributions.
- Finally, we will include an interview with a leading policy-maker and/ economic thinker. This feature, designed to highlight economic issues through the experiences of actual policy practitioners, is also hopefully a vehicle through which readers might gain career and other insights.

In this first issue of MEB we have two long Analytical Papers, six Technical Policy Briefs, and a First-Person Interview with the Deputy Governor of the Central Bank of Myanmar, U Bo Bo Nge.

Analytical Papers

Trade and Transport: Subnational Convergence in Myanmar, is written by Jonah Rexer, a scholar of economics (and Myanmar) from the Wharton Business School, University of Pennsylvania, and a visiting scholar at MDI through much of 2017. Jonah explores an issue that could scarcely be more relevant for Myanmar – how to achieve not just growth and development, but growth and development that is inclusive of all of Myanmar's states, regions and peoples.

Jonah uses all the expected data sources in the determining economic inequality in Myanmar, but greatly expands upon these via the creative use of satellite images of 'night lights' to predict economic activity. Since the seminal work of Henderson, Storyguard and Weil (2012), this methodology has proved its worth as a strong predictor of income and rates of growth, but especially with respect to geographic locations where data is otherwise lacking or poorly collected.

Using the night-lights methodology, Jonah makes a couple of groundbreaking discoveries on the convergence of economic growth in Myanmar at the subnational level. First, economic growth rates of most states and regions in Myanmar seem to be converging between 2005 and 2013. Second, Chin and Rakhine especially stand out in sharing little of Myanmar's recent growth, standing askance from the growth convergence evident in varying degrees across other states and regions.

What are the drivers of this convergence in economic growth at the subnational level? Jonah finds that in addition to conflict, key to it all is the extent to which frictions exist in factor mobility. In other words, there seems to be a robust link between the existence and ability to access major roads and rail lines in a geographic area, and the rates of income growth and convergence.

Jonah also addresses the role of trade costs in the dynamics of subnational convergence. Using geographical distance as proxy for trade costs, he infers that convergence in Myanmar has been driven by internal infrastructure and within-country market integration, rather than by cross-border trade with neighbouring countries. Jonah's policy recommendations flow naturally from these findings, and accordingly he points to the need for targeted policy interventions for lagging regions such as Chin and Rakhine. As such, Jonah speaks to the need to prioritise investment in transport infrastructure linking lagging and remote regions with both border trade centres and major metropolitan cities. Jonah ends optimistically, asserting thus the power of broad-based income growth in reducing inequality, and in binding the country together as a more prosperous and peaceful whole.

Our second long analytical report, *Path to Diversification: Analysing Myanmar's Product Space, Competitiveness and Complexity in Identifying Feasible Products* by

Aka Kyaw Min Maw, likewise cannot surely be topped for relevance with respect to Myanmar's quest for transformational economic growth. A visiting researcher at the MDI, Aka applies to Myanmar the pioneering work most associated with Harvard's Ricardo Hausmann to pose the question – what should Myanmar do to move up the productive value chain, to move from the extraction of raw materials, energy and primary products, into more complex outputs that generate higher returns, and positive development externalities.

It is, of course, a critical question that, attested by a plethora of failed industry policies the world over (historically Myanmar included), difficult to get right, but Aka uses concepts developed by Hausmann to explore plausible strategies to diversify Myanmar's export basket based on a country's current capabilities, and those that might be plausibly accruing. In determining the latter, Aka not only explores the nature of Myanmar's productive capabilities at present, but also those that might be revealed by an examination of the economic trajectory of peer countries.

Noting that Myanmar's current export basket consists of products of relatively low-complexity (and, accordingly, offering little in the way of development benefits beyond simply income), Aka finds that textiles, processed food and moderately complex manufactures are all products over which Myanmar could compete in global markets. To get there, and as per the paper of Jonah above, Aka recommends certain foundational investments. In this case, highlighted by Aka, in education:

> …it would not be possible to export sophisticated products without a proper pool of human resources. Even though returns from investment in human capital cannot be realized in the short term, the creation of new high added-value activities and the export of sophisticated products requires improved training, and a better education system.

Technical and Policy Briefs

MEB's Technical and Policy briefs are primarily (but not exclusively) the product of MDI's excellent team of early-career researchers, and in this context represent tools of analysis applied to particular issues, but applicable and relevant to other matters too.

Readers will find in this first issue of MEB six such briefs, covering infrastructure, labour productivity and output gaps, inflation as it may be manifested at election times, fiscal policy management, foreign direct investment and on-the-job training.

In *What is Infrastructure,* MDI Executive Director Dr. Min Ye Paing Hein takes on a truth that underlies many a development program, that 'infrastructure' (and our author takes the time to define this erstwhile slippery concept) is foundational to growth and development, more or less everywhere. Myanmar, he notes, 'has the lowest infrastructure per person for all low-income countries'. Of course, this is currently a significant problem, but it has a future upside (in company with other poor countries) in that even modest improvements in infrastructure can yield disproportionate social dividends; '…rapid development of infrastructure in Myanmar will have rapid, robust and rigorous impacts on economic growth and the welfare of the people in the country'.

One of the most difficult hurdles to improving a country's infrastructure is financing it and, in this Brief, Min reviews some of the financing possibilities, from simple budget allocations, official development assistance, to various private-public partnership arrangements (PPP).

Dr. Khin Maung Nyunt is the Senior Research Fellow at MDI, and our second Brief, *Labour Productivity, Potential Output and Output Gap: A Useful Tool for Budgetary Surveillance and Fiscal Policy of Myanmar,* is written by this esteemed scholar. Introducing techniques and methodologies for determining how far Myanmar's economic output is from its potential frontier, Khin Maung Nyunt's paper is also readily useful in deciding what to do about it, through the application of discretionary macroeconomic policies. The elegance of the model presented here is matched thus by its utility as a device for spending and other decisions that do not lead to either inflation or unemployment, but which, ex-ante at least, might be 'just right'.

Inflation is the topic at hand for a research Brief written by two of MDI's research associates, Han Wai Sett and Myat Su Tin. In this case, the inflation of concern is that which may arise at election times. Myanmar has not been overburdened by such events in the past, but in *The Election Fever of Consumer Price Index in Myanmar,* Han Wai Sett and Myat Su Tin do indeed find that Myanmar's overall consumer price index (CPI) was sensitive to the election of 2015 – spiking just before election day, and falling rapidly thereafter. Disaggregating, they find an even more interesting story – it is the food component of the CPI that is the determining factor. The reason? The behaviour of people:

> …in an economy like Myanmar, which has faced different political crises since the independence of the nation, is that people buy and store food when they expect the possibility of political crises. The jumps in CPI and food CPI series reflect these concerns. The downward jumps and rapid decrease in CPI and food CPI also signal that expenditures returned to normal after the assurance against the possibility of political crises.

Fiscal Policy Management in Myanmar is written by MDI research associate Aung Phyo Kyaw, who describes the heroic task of recent governments to lean against the country's chronic tendency towards large and unsustainable budget deficits. Aung Phyo Kyaw explores the various measures designed to deliver fiscal prudence, from tax reform, budget transparency initiatives, public debt management systems, procurement reforms, to progress in developing Treasury bond and bill markets. Of particular note is the present government's progress in eliminating central bank 'money financing' of budget deficits, an outcome which, if achieved as planned, really will revolutionise Myanmar's fiscal affairs, and set the stage for a stable macro-economy more broadly.

An Analysis on Foreign Direct Investment in Myanmar, by MDI research associates Mary Nan Myint and Zar Ni Maung, outlines another source via which Myanmar hopes to achieve transformational growth, this time via resources flowing into the country from abroad. Noting that FDI is more than just a source of finance, Mary Nan Myint and Zar Ni Maung pay particular attention to its role in technological and methodological diffusion. They provide a nuanced account on the nexus between FDI inflows and economic growth with the message that positive effects of FDI on a host economy depend not only on local conditions and policies, but also on the sectoral composition of FDI inflows. They also note the ways in which FDI has been successfully (and unsuccessfully) applied in other countries, and conclude with an analysis of some of the challenges to FDI in Myanmar (highlighting infrastructure problems especially) and the limitations of collecting data in this critical sector.

Our final Brief, by Phyo Nge Thinn Lwin, examines the crucial question of on-the-job training, and its formal but related cousin, technical and vocational education (TVET). Providing examples of how both have been crucial to the economic success of countries such as South Korea and Germany, Phyo Nge notes that various cultural biases in Myanmar discourage students away from such training and towards professions regarded as more prestigious. He also outlines some of the difficulties firms face in providing training and suggests certain government policies to address the shortfalls.

As noted earlier, each issue of MEB will end with a feature interview of a leading economic policy-maker and practitioner. In this first edition, however, we also looked for someone whose struggle (very much against the odds) could be something that many younger readers could identify with, and perhaps receive inspiration from. In this spirit, our first interviewee, Deputy Governor of the Central Bank of Myanmar, U Bo Bo Nge, could not surely be bettered. A nice way, we think, to conclude our first edition of MEB, and a harbinger of what is to come.

Sean Turnell

TRADE AND TRANSPORT: SUBNATIONAL CONVERGENCE IN MYANMAR

Jonah Rexer[†]

SUMMARY

Balanced income growth across subnational regions is a key development priority in many developing countries. This issue is particularly acute in Myanmar, given a long history of ethnic conflict with roots in a widespread perception of spatial inequality. I use satellite imagery of light emissions at night from 1992-2013 to predict income levels and growth at varying degrees of administrative aggregation, uncovering several basic facts. Firstly, there is a significant discrepancy between GDP levels and growth as predicted by night lights and as measured in national accounts, and this discrepancy is large relative to regional and income peers. Secondly, there is heterogeneity in state-level income growth rates and levels, implying spatial inequality remains a key concern for Myanmar. Thirdly, however, growth regressions suggest strong unconditional convergence on average both within and across states, with convergence rates monotonically increasing over time. Finally, the extent of income growth and the rate of convergence is positively influenced by the existence and length of major roads and rail lines, suggesting that barriers to factor mobility and insufficient spatial integration play a key role in explaining the persistence of regional inequality.

[†] Wharton School of Business, University of Pennsylvania and Myanmar Development Institute. Special thanks are due to Seth Goodman at AidData, William and Mary College, for his tremendous help with geospatial data extraction and processing, and Aka Kyaw Min Maw and Min Ye Paing Hein for many helpful comments.

1 INTRODUCTION

Many developing countries deal with stark levels of inequality in living standards across subnational regions. In fast-growing emerging economies, a typical concern of policymakers is that growth will be primarily concentrated in few dynamic urban centers, while peripheral rural areas stagnate. The dangers of sustained regional inequality are severalfold. Such disparities may fuel excess internal migration, irregular urban development, and the expansion of slums. Perhaps most importantly, in countries where ethnic or sectarian and regional boundaries coincide, regional inequality may be a catalyst of political violence and civil conflict (Guariso and Rogall 2016, Ostby et al. 2009).

The issue of regional inequality is particularly urgent for Myanmar. Though Myanmar remains the poorest country in Southeast Asia (World Bank) gradual economic and political reforms have resulted in substantial income growth. However, the spatial distribution of gains from reform is unknown. As the world's youngest democracy, excess regional inequality could threaten the fragile process of political transition, particularly if large numbers of migrants flock to urban centers in search of employment. Additionally, Myanmar is home to 135 officially recognized ethnic groups, many of which have been engaged in ongoing civil conflict with the military government since 1948. Since there is substantial overlap between regional and ethnic boundaries, achieving some degree of regional economic convergence may be the key to the elusive goal of national unification and peace.

This paper aims to estimate both the current extent of regional inequality, and quantitatively assess the process of subnational convergence in Myanmar over the period of 1995-2013. Economic growth theory suggests that convergence should occur. At the level of nations, neoclassical growth models (Solow, Ramsey-Cass-Koopmans) predict that, conditional on a small set of observable features, economies should to converge toward a unique steady-state level of income. The obvious empirical implication of conditional convergence is that initially poorer areas should experience faster income growth. The logic is straightforward, and based on two critical assumptions: the absence of substantial frictions in the markets for labour, capital, and goods, and the existence of a neoclassical aggregate production function with constant returns to scale and diminishing marginal returns to factors. Since capital should flow to the investments of highest return, diminishing returns implies that these investments should be located in poor countries. Variants of neoclassical models have spawned an entire cottage industry of "growth regressions," estimating cross-national convergence rates and their mediating factors. The accumulation of evidence suggest that convergence is indeed the norm (Barro 1991, Mankiw, Romer and Weil 1992,

Barro and Sala-i-Martin 1992, 1995), with an average convergence rate across studies of roughly 2%.

The same logic, prima facie, applies to subnational regions within countries. However, perhaps due to a lack of reliable subnational income data, there has been much less theoretical and empirical work on the topic. If anything, many of the variables that may condition the likelihood of convergence across countries – national institutions and policies, political dynamics, colonial history, geography, etc – are held constant within countries. In addition, factors such as labour and capital should be more mobile within countries. Yet there are reasons why within-country regional convergence may not occur. Returns to scale, externalities, and agglomeration economies (Glaeser 2010) may lead to spatial concentration of economic activity. If bad policies, information failures, poor infrastructure, or limited banking systems create frictions in factor mobility, then regional convergence is not be guaranteed. Certainly, the existence of persistent regional inequality in many countries suggests that these must play a role. Gennaioili et al (2014) outline a theoretical framework for regional convergence in a neoclassical growth model, highlighting the importance of internal frictions in labor and capital markets for the rate of regional convergence.

Given a lack of subnational panel data on population and income for Myanmar, I use satellite images of light emissions at night to construct a dataset of subnational income levels and growth rates from 1992-2013 at various levels of administrative disaggregation.[1] Night lights have gained prominence in recent economic research because of their strong ability to predict economic activity and availability at a spatial resolution at which economic data typically are not collected. In the seminal work of Henderson, Storeyguard, and Weil (2012) (hereafter HSW), night lights are established as a robust predictor of income levels and growth. Numerous papers thereafter have used night lights as an indicator of economic activity. Most relevant is work by Bundervoet et al (2015) and Chanda and Kabiraj (2017), which use night lights to estimate subnational income growth in Kenya and India, respectively.

The analysis uncovers several basic facts about national and subnational income growth in Myanmar. I am able to replicate the results of HSW and others using similar specifications, though over a longer period and with a different sample of countries. However, while the night lights model fits the national income series relatively well across a selection of Southeast Asian countries of varying levels of development, this fit is notably weaker for Myanmar, revealing a persistent upward bias in national accounts measures of GDP levels and growth. Estimating

1 In particular, I conduct analysis at both the state and township levels, which are the first and third administrative levels in Myanmar

state-level GDP per capita in 2014, I find the existence of substantial regional inequalities, observing an severalfold gap between the country's richest state, Mandalay, and it's poorest, Chin. I also document substantial heterogeneities in state-level growth, with average annualized state-level GDP growth rates from 2005-2013 ranging from 4.5% in Chin to 13% in Bago, against a national state average of 8.76%. I then estimate township-level Barro (1991) growth regressions, using long-difference growth estimates based on lights from 1995-2013, 2000-2013 and 2005-2013. I find strong evidence of unconditional convergence, with the convergence rate increasing over time, from 1% in the 1995-2013 period to 2.5% in the 2005-2013 period. Finally, consistent with theory, I find that frictions in factor mobility moderate the convergence rate. In particular, the presence of physical infrastructure– roads and rail – is positively associated with growth and increases the rate of convergence.

2 DATA AND ESTIMATION

2.1 Data sources

Satellite images of stable light emissions at night come from the Version 4 DMSP-OLS Nighttime Lights Time Series of the National Oceanic and Atmosphere Administration (NOAA). The DMSP-OLS series provides gridded raster images of stable night lights at a resolution of 30 ´ 30 arc seconds, or approximately 1 km^2 at the equator. Though they are not the only satellite images, they have become the standard data source for economic analysis using night lights data. For each grid point, the satellite assigns an integer pixel value, or Digital Number (DN), which ranges from 0 to 63. The DN thus captures the intensity, or brightness, of stable light emissions at any given grid point in the world. The series spans 1992-2013, although the changes in the satellite technology over time create challenges for longitudinal analysis. However, Elvidge et al. (2014) calibrate coefficients to deal with comparability issues that arise in the time series.[2] I use the calibrated data, extracted from the geo(query) tool at AidData, a development economics research lab at William and Mary College,[3] which processes geospatial data requests for a variety of subnational administrative units across a wide range of countries.

A few notes are in order about the lights data. Firstly, the relationship that is estimated between lights and income is based on the observation that lights are a precondition for economic activity to take place at night. However, the estimated relationship says nothing about the direction of causality between lights and

2 Although, strictly speaking such calibration is unnecessary if year fixed effects are included in all regressions.

3 http://geo.aiddata.org/query/

income. Simply put, lights are used to predict income because an observed strong correlation between the two variables implies that lights are a good proxy for income, rather than because of some underlying structural theory about the relationship. There is a substantial empirical literature validating the underlying relationship between lights and income (Pinkovskiy and Sala-i-Martin 2013, Pinkovskiy 2017, HSW 2012). Since that is not the primary focus of this paper, the reader is directed to these references.

Still, it is necessary to mention a few relevant sources of measurement error introduced by using lights. Perhaps most importantly lights will tend to underestimate income levels in areas where unlit agriculture is a large share of output. Given that luminosity is top-coded, it will also undercount growth in areas where pixels are already fully saturated. This implies that both income in poor rural areas and growth in rich urban areas will both be underestimated. Since this error is non-random and may introduce bias in the convergence estimates, I conduct several robustness tests to suggest that these sources of error do not materially affect the results.

Population data comes from version 4 of the Gridded Population of the World dataset housed at NASA and Columbia University,[4] which is available at the same resolution as night lights, and is also extracted using AidData's geo(query) tool. Administrative boundaries for Myanmar townships and states and regions are from the Myanmar Information Management Unit (MIMU). Data on the Myanmar road, rail, and waterway network is also from MIMU for the year 2011. Finally, national income and population data is taken from the World Bank's World Development Indicators (WDI). The WDI sample includes approximately 153 countries from 1992-2013, resulting in a sample of 3366 country-years, though GDP data is missing for 135 country-years.

2.2 Estimation framework

The intuition behind the night lights-income estimation framework is straightforward. To convert night light emissions into GDP levels, a linear-in-logs function is estimated that links GDP to the density of lights per unit area. Since income is typically only observed at the national level, this model is estimated at the country-year level. It includes country and year fixed effects to absorb global time-varying income shocks (as well as time-varying uniform measurement error in the lights series) as well as country-specific, time invariant unobserved heterogeneity. The predicted values of this equation can then be retransformed to provide levels of GDP and divided by population to yield estimates of GDP per

4 http://sedac.ciesin.columbia.edu/data/set/gpw-v4-population-count-adjusted-to-2015-unwpp-country-totals

capita. Following the canonical specification of HSW, I estimate for country i in year t

$$\log(Y_{it}) = \alpha + \beta \log\left(\frac{NL_{it}}{km_{it}^2}\right) + \delta_t + \phi_i + \varepsilon_{it} \quad (1)$$

Where Y_{it} is national accounts income in 2010 constant US dollars, $\frac{NL_{it}}{km_{it}^2}$ is light density, defined as the sum of the DN across all grid-cells in a given country-year divided by the country area in square kilometers, δ_t is a time fixed effect, and ϕ_i is a country fixed effect. Note that the fixed effects act as additive terms that adjust country and time-specific intercepts such that lights-predicted $\log(Y_{it})$ is of the same scale as "true" $\log(Y_{it})$ in each country and in each year.

Growth estimation proceeds similarly. Since equation (1) is in log-log form, taking differences yields growth in GDP as a function of growth in light density. Differencing also removes the time-invariant country-specific intercept term ϕ_i. Since year-on-year growth numbers are likely to be noisy for both lights and national accounts data, the literature tends to use long differences instead of first-differences. Indeed, as the results of the estimation exercise demonstrate, the goodness of fit in the growth regressions falls as the differences are shortened. Formally, I estimate

$$\Delta \log(Y_{it}) = \alpha + \beta \Delta \log\left(\frac{NL_{it}}{km_{it}^2}\right) + \upsilon_{it} \quad (2)$$

Where $\Delta \log(Y_{it}) = \log(Y_{it}) - \log(Y_{i\tau})$ for some lag τ. For the long difference estimates, I set t=2013 in order to utilize the most current data, and use as my base years τ= 1995, 2000, and 2005. These choices are relatively arbitrary,[5] but are chosen because subnational population data for Myanmar was non-existent until the 2014 National Census. Gridded population estimates, however, are available only in 5-year intervals over the sample period, from 1990-2015. Thus, in order to conduct the subnational analysis of GDP per capita, we are confined to these years.

However, the log difference specification in equation 2 allows only estimates of growth in GDP. A separate but related exercise analyses the extent to which the transformed growth rates of GDP *per capita* are reliable predictors of national accounts GDP per capita growth. Ideally, if equation (1) properly calibrates levels of GDP and therefore GDP per capita, then observed growth rates in the predicted values should match 1 for 1 with the "true" values. Here, I re-transform the predicted values of equation 1 to GDP per capita, and calculate long difference growth rates in the predicted series. I then regress long differences in GDP per capita on long differences in predicted DP per capita. Of course this regression

5 However, different intervals yield qualitatively similar results in both coefficient estimates and goodness of fit.

may not achieve a coefficient of unity, because of measurement error in national accounts GDP, and residual prediction error in equation 1. In fact, this discrepancy becomes particularly important for Myanmar, where the reliability of national accounts data has long been an issue (IMF 2015a, Bolnick 2016).

2.3 Baseline results

The results are quantitatively similar to HSW, who perform the same exercise on a slightly larger sample of countries (*n*=188) over a shorter time period (1992-2008), and Bundervoet et al. (2015) who perform the same estimation on a panel of only sub-Saharan African countries.

In Table 1, column 1, I find the elasticity of GDP with respect to light density to be 0.256, significant at the 1% level, an estimate nearly identical to that obtained by HSW despite the difference in sample and time period. The predictive power of the model is strong; the within-country R^2 of 0.8 implies that for a given country, 80% of the within-country variation in GDP over time can be explained by variation in lights over time. The between R^2 of the fixed-effects model is 0.42, indicating that for a given year, 42% of the cross-sectional income differences can be explained by light density.

Table 1: Baseline results, levels and growth

Outcome	log(GDP)	Long difference, GDP			Long difference, GDP per capita		
Period		1995-2013	2000-2013	2000-2013	1995-2013	2000-2013	2005-2013
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(lights per square km)	0.256*** (0.037)						
Growth in lights		0.471*** (0.049)	0.390*** (0.057)	0.319*** (0.041)			
Growth in predicted GDPPC					0.988*** (0.103)	0.727*** (0.149)	0.567*** (0.137)
Observations	3231	143	147	148	143	147	148
R^2	0.8	0.42	0.276	0.27	0.365	0.245	0.176

Standard errors are clustered at the country level. Column (1) includes country and year fixed effects, and reports the within-country R^2. Columns (5)-(7) report regressions of long differenced log per capita GDP on long differenced predicted log per capita GDP using predicted values of equation (1).

*** p<0.01, ** p<0.05, * p<0.1

The strong predictive power of the overall model is displayed in Figure 1, which plots the predicted values of equation 1 transformed in per capita terms against the national accounts values of log (GDP per capita) for the year 2013. The

scatterplot is relative to the 45-degree line, where points on the line imply a perfect model prediction. Most points do indeed lie on or very near the line, implying that in 2013, equation 1 predicts income per capita very well. I highlight Myanmar in order to emphasize that it lies below the 45-degree line, implying that the lights-predicted GDP per capita is lower than the measured GDP per capita. Myanmar is certainly not the only country where lights under-predict GDP, however, Figure 1 does not seem to reveal a systematic under-prediction for poorer countries, which may rely more on unlit agriculture. Additionally, though the discrepancy appears small, the log scale is deceiving. In levels, there is a $391 gap between the measured 2013 GDP per capita and the lights-predicted.

Figure 2 demonstrates that in six different ASEAN nations, equation 1 does a rather good job of predicting national GDP per capita. In each country, lights-predicted GDP per capita closely tracks national accounts data. In 2013 the discrepancy between predicted and actual GDP per capita does not exceed 11% in the six reference countries, while this discrepancy in Myanmar is approximately 40%. The reference group represents a wide range of income levels and economic structures, including i) low income agricultural economies such as Lao PDR and Cambodia, ii) rapidly industrializing lower-middle-income economies such as Indonesia and Vietnam, and iii) middle-income countries with well-developed manufacturing sectors, such as Thailand and Malaysia. This suggests that it is not a feature of the underlying economic structure that is contributing to the substantial gap in the Myanmar prediction, but rather upward biased measurement error in national accounts data.

Figure 1: Lights-predicted GDP per capita

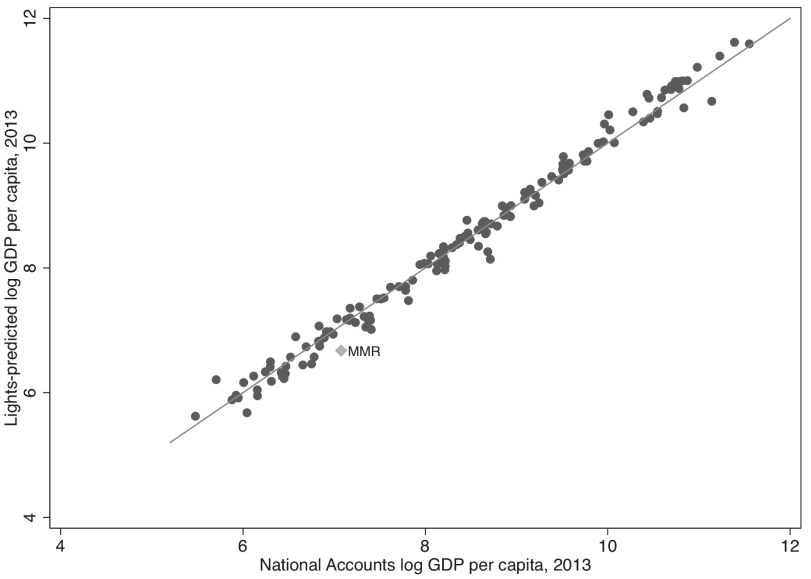
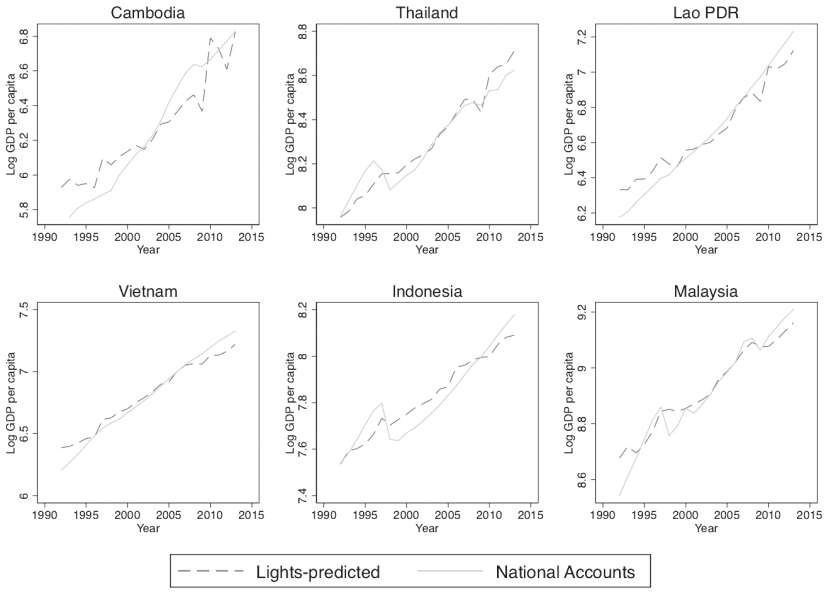


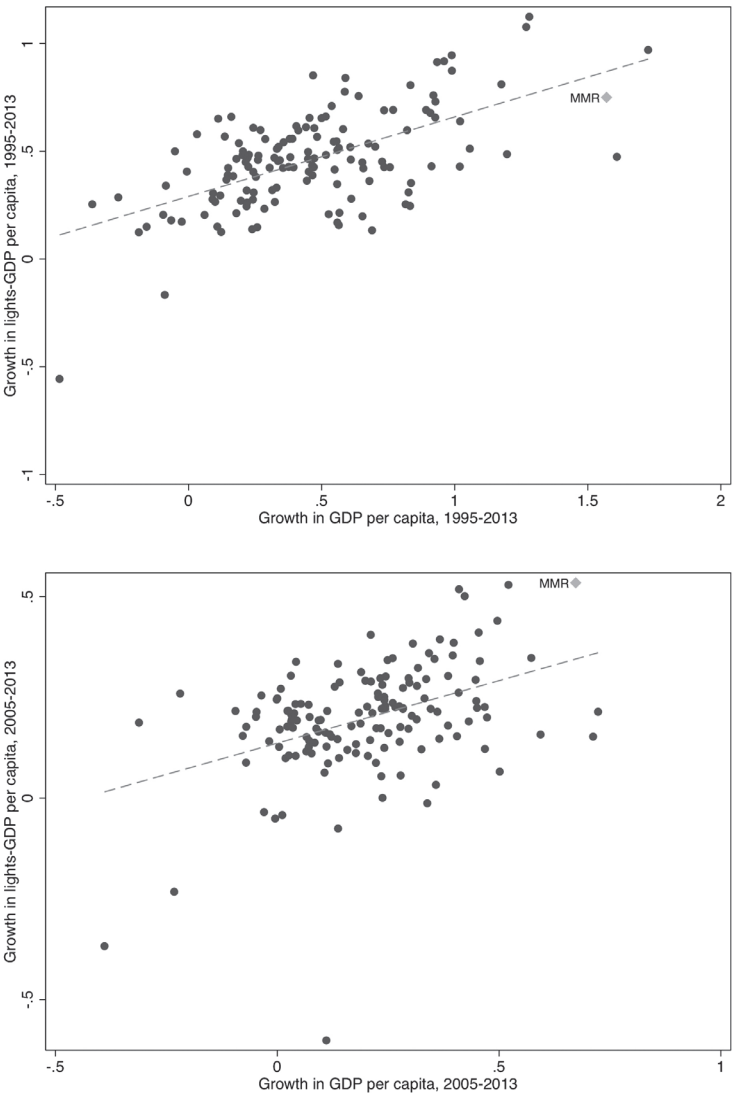
Figure 2: Quality of prediction in Southeast Asia



Turning to income growth, Table 1 columns 2-4 present long-difference estimates of equation two for the three time periods of focus. Consistent with the idea that shorter periods introduce more noise into growth estimates, I find both the coefficient estimate and are monotonically decreasing in the length of the difference. For the 1995-2013 difference, a one percentage point increase in the rate of lights growth is associated with a 0.471 percentage point increase in the rate of GDP growth, a relationship which falls to 0.39 in 2000 and 0.319 in 2005. Similarly, the falls from a rather strong fit of 0.42 for the 1995 difference to 0.27 for the 2005 difference. Still, all estimates are significant at the 1% level, indicating a strong association between growth rates of lights and income at the country level. Columns 5-7 translate these growth rates into per capita terms, taking the long differences from the predictions generated by equation 1. The results are again consistent with weaker predictive power for shorter differences. For the period of 1995-2013, there is essentially a one-to-one average relationship between lights-predicted GDP per capita growth and true growth. However, this relationship becomes weaker as the difference becomes shorter. Figure 3 visualizes this relationship, which shows that both the slope and model fit reduce over time. Interestingly, however, Myanmar's official growth estimates actually converge more closely to lights-based estimates over time. Overall, suggests that while growth in lights or predicted incomes at the subnational level may reliably provide information about true growth, there is likely to be substantial variance

in the actual estimates of subnational growth rates. Thus, we should trust the average effects presented in the growth regressions more than any given point estimate of growth for a specific state or township.

Figure 3: Growth calibration, long-differences



2.4 National growth in Myanmar

How well does the model predict income levels and growth in Myanmar? As noted, relative to its regional peers, the prediction quality for Myanmar is not very good. In fact, as Figure 4 demonstrates, the correspondence between lights-predicted log GDP per capita and actual log GDP per capita is relatively limited. In levels, 2013 income per capita as predicted by lights is substantially lower than that measured by national accounts data. Growth is also substantially higher in the national accounts data than as estimated by the night lights specification of equation (2). As Table 2 indicates, lights-predicted income growth from 1995-2013 is nearly 4 percentage points lower than official figures and nearly 5 percentage points lower from 2000-2013. Similar discrepancies are observed for per capita income growth rates. Importantly, however, the gap between national accounts and lights-predicted growth seems to have narrowed substantially, to only about 1 percentage point from 2005-2013. However, whether this reflects improved national income aggregation practices or simply noise from the night lights estimation is unclear.

Figure 4: Quality of prediction in Myanmar

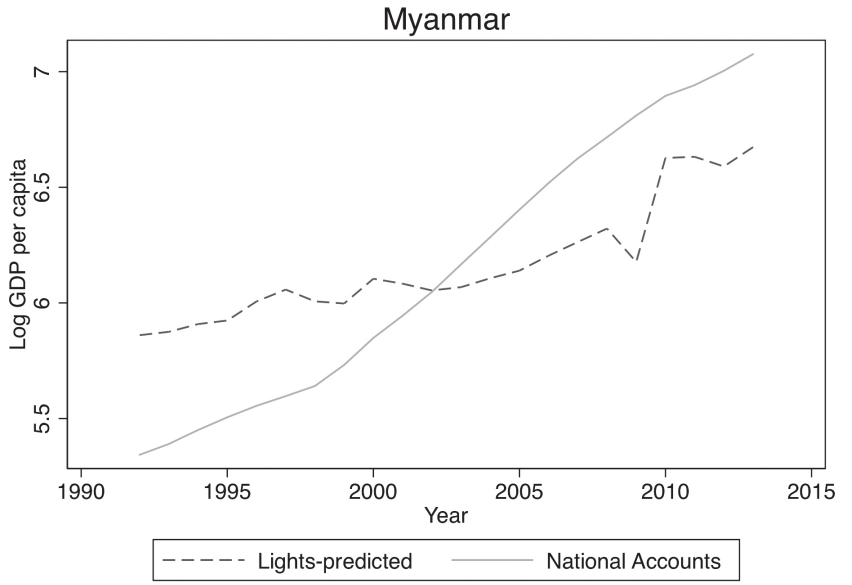
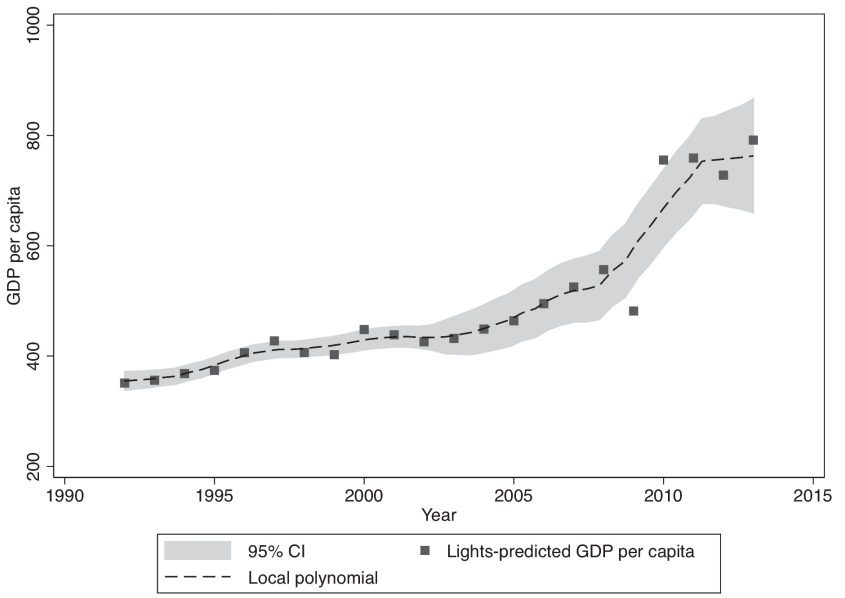


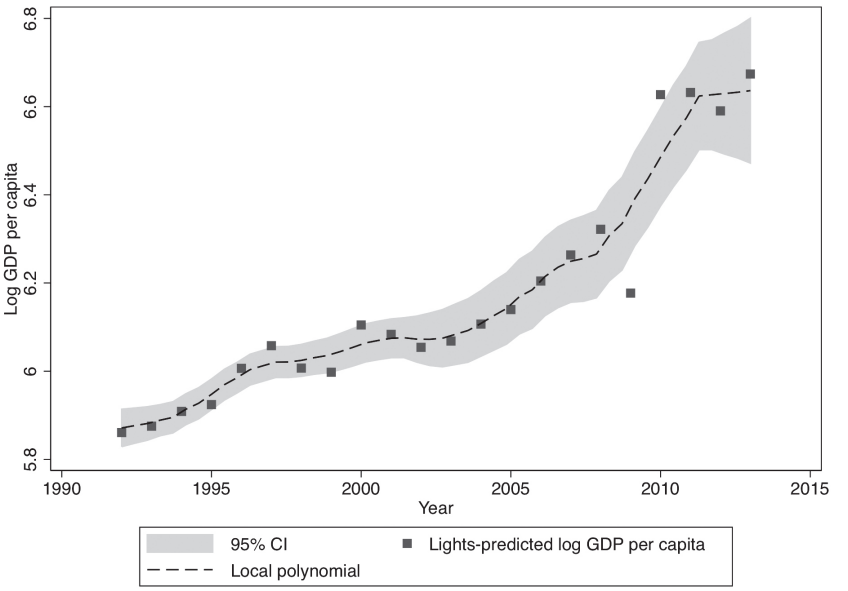
Table 2: Annualized growth rates

Period	Night Lights	Nat'l Accounts	HSW Optimal
Panel A: GDP			
1995-2013	6.21	10.18	8.11
2000-2013	5.96	10.83	8.3
2005-2013	8.6	9.58	9.07
Panel B: GDP per capita			
1995-2013	4.25	9.12	6.59
2000-2013	4.47	9.9	7.08
2005-2013	6.91	8.77	7.8

Given the rather glaring discrepancies between the lights prediction and national accounts, how should we estimate GDP growth? Based on a statistical model proposed by HSW, optimal weights can be calculated for countries with poor data quality to estimate "true" growth as a convex combination of night lights and national accounts growth rates. I take these weights directly from HSW, who place a weight of 0.48 on national accounts data and 0.52 lights data. These revised growth rates are presented in Table 2, which indicates downward growth rate revisions for all periods. The size of the discrepancy and thus the downward revision is greatest in the 2000-2013 period.

Figure 5: Lights-predicted GDP growth in Myanmar





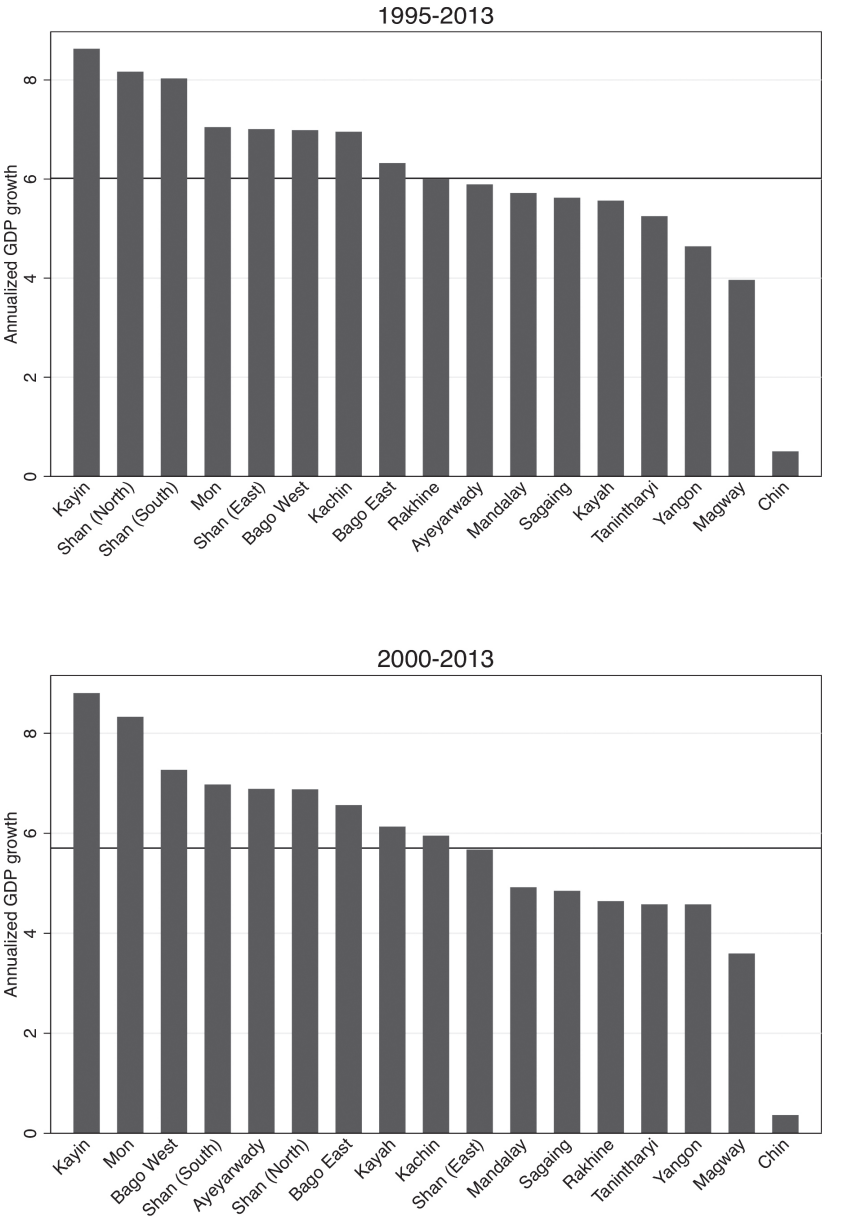
3 STATES AND REGIONS

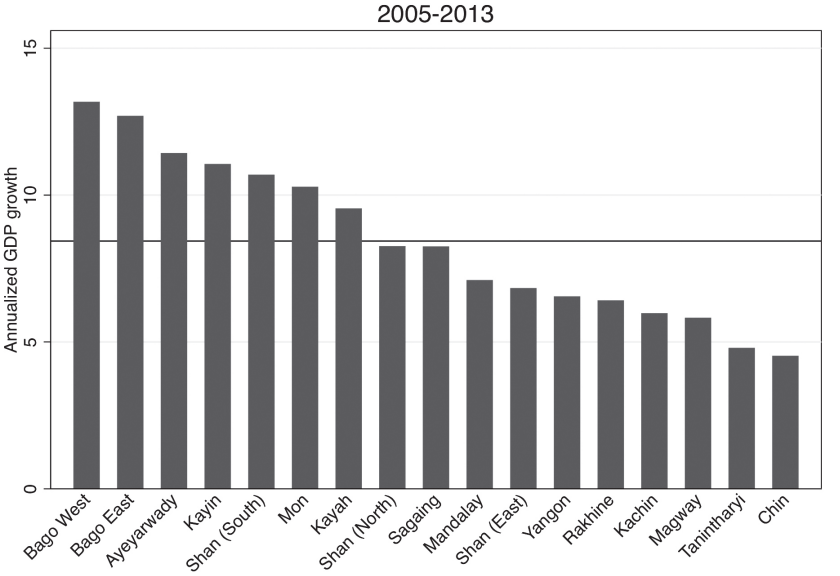
3.1 State growth rates

Using the coefficient estimates of equation (2) applied to state-level lights differences, I estimate state-level income growth rates, which are presented in Figure 6. In each graph, I exclude Nay Pyi Taw, which is the fastest-growing state in every period and a significant outlier.[6]

6 There is reason to believe that the relationship between income and lights in Nay Pyi Taw may be less robust than in other states due to the distortions in light data introduced by the presence of many large hotels.

Figure 6: State-level growth rates





The results reveal that the average state-level growth rate has been relatively robust over each period considered. From 1995-2013, average state-level income growth was 6%, from 2000-2013 states averaged 5.7% growth, and from 2005-2013 this figure has jumped to 8.43%. However, there is substantial variation in state growth rates. At the low end, Chin state has the slowest growth in every period, achieving less than 1% income growth until 2000, and about 4.5% from 2005-2013, a rate about half the national average. In the most recent period, Tanintharyi, Magway, Kachin, and Rakhine have also experienced relatively slow growth. On the high end, top performers have consistently been Bago (East and West), which averaged a robust 13% annual growth rate from 2005-2013, Ayeyarwaddy, which has grown at 11.4% annually since 2005, and Kayin, growing at 11.05%. Interestingly, while the economic hubs of Yangon and Mandalay have grown at a healthy 6.5 and 7.1% respectively from 2005-2013, they come in below the state-level average in each period. This descriptive result, however, is consistent with the formal estimation of convergence rates in the subsequent section.

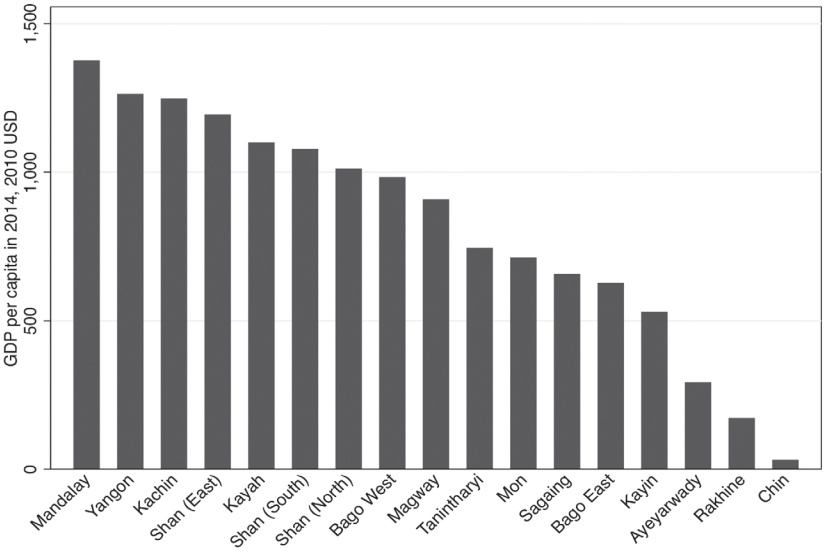
In absence of more comprehensive state-level economic data, we can only speculate as to the causes of the observed heterogeneity in growth rates. Certainly the remoteness and lack of infrastructure in Chin and Tanintharyi, both of which have limited access to the country's road and rail network play a role in explaining slow growth, a fact confirmed subsequently in the estimation. Strong growth in Shan (South) and Kayin may be explained by the presence of cross-border trade with Thailand, as inspection of the night lights map reveals a substantial expansion of lights in border areas. In primarily agricultural Ayeyarwaddy, proximity to

Yangon, relatively dense road infrastructure, and the integration of the agricultural output market may play a role. Bago also seems to benefit from its strategic location, with much of the growth in lights occurring near road and rail points along the Yangon-Naypyitaw-Mandalay corridor. However, a more detailed analysis of the composition of economic activity and employment over time is required to understand the fundamental causes of differences in growth rates, and whether they reflect underlying structural transformation.

3.2 State GDP

Moving from growth to levels, state-level GDP per capita is estimated as follows. First, I sum lights at the country level, and calculate the share of national lights contributed by each state in each year. Then, I use the predicted values of equation 1 for Myanmar to estimate national income. In a final step, I distribute national income to states in proportion to their share in lights, and divide by the state-level population to arrive at per capita income. I estimate income in 2014 in order to allow for the use of official population data from the national census. However, since lights data is not available in 2014, this requires projecting income in 2014 through extrapolation of estimated long difference growth rates. To do this, I use the 2005-2013 state-level growth estimates and 2005 as the base year. Then, applying the 2005-2013 annualized growth rate to the 2005 estimated state income levels, I predict state-level incomes in 2014, and divide by official population numbers from the 2014 census. This yields the per capita income estimates of Figure 7.

Figure 7: State-level GDP per capita, 2014



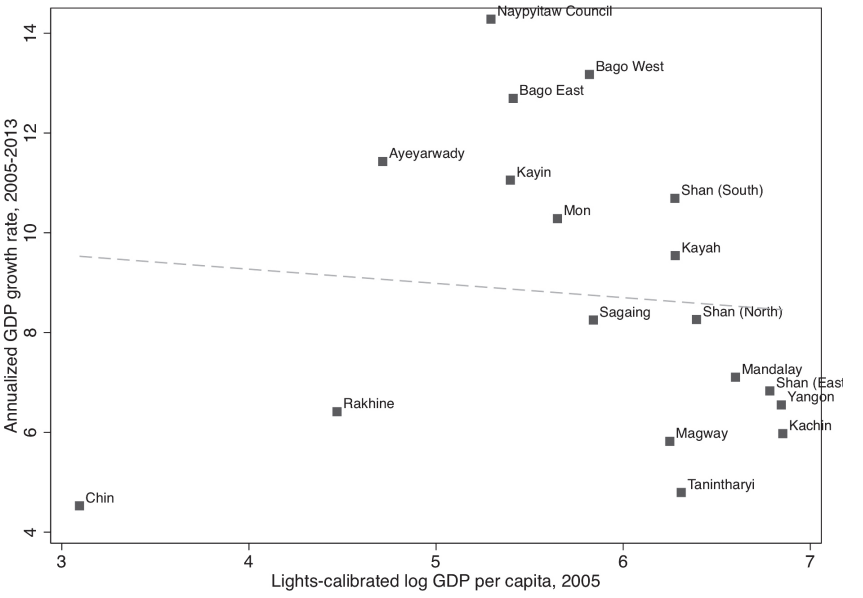
The results reveal wide income gaps across the country. As expected, Yangon and Mandalay are the richest states, with estimated per capita incomes of 1,376 and 1,257, respectively, measured in constant 2011 USD. The poorest states are Rakhine and Chin, with per capita incomes of 171 and 31, respectively. While these may appear implausibly low, it is important to note that these are undoubtedly the poorest states in Myanmar, with extremely high poverty rates of 73% and 44% according to the official 2010 estimates (UN/CSO 2010). While the qualitative pattern of the results seems reasonable, it is possible that the exact levels of income may be underestimated for Rakhine and Chin, which are 83% and 79% rural and where unlit agriculture may account for the vast majority of economic activity. Still, the estimated income levels indicate that despite strong growth across the country, significant spatial inequality persists.

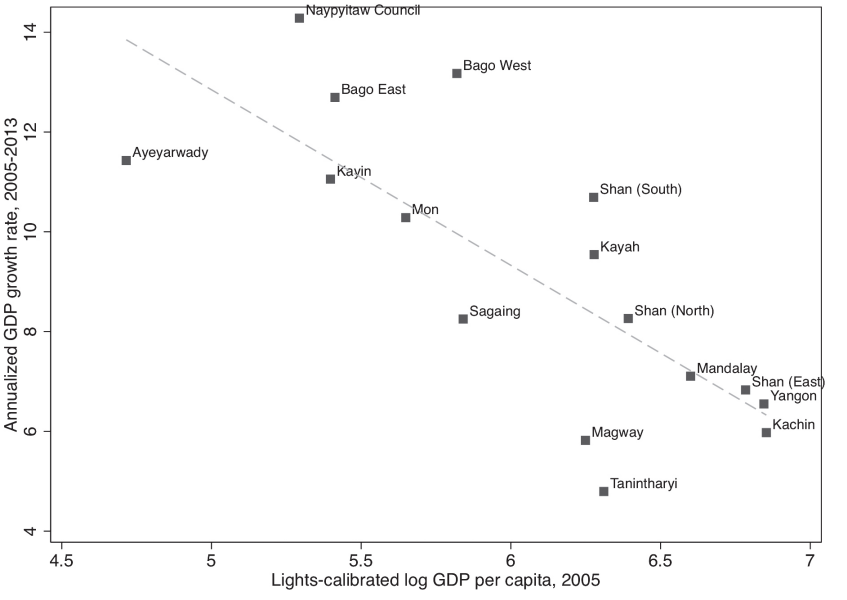
3.3 Convergence across states

The descriptive results on income growth and levels suggest that while there has been substantial growth across the country, convergence is far from clear. In particular, the stark inequalities across states are hard to square with convergence. Figure 8 sheds some light on this question, by estimating a bivariate convergence regression at the state level, plotting initial GDP per capita in 2005 against growth from 2005-2013. Convergence would imply a negative slope. Panel A reveals that, on average across states there is little evidence of a strong convergence trend. The slope is not significantly different from zero, and there appears to be no clear negative correlation between initial income and subsequent growth.

However, a closer inspection reveals that this null result is primarily driven by two outlying states, Rakhine and Chin. Once these are removed from the sample, a strong negative correlation emerges in Figure 8, Panel B. On average convergence across states appears to be strong, with an estimated slope of -3.5, implying that a one percent increase in state-level GDP per capita in 2005 is associated with a 3.5 percentage points reduction in the subsequent annual growth rate from 2005 to 2013. The results suggest that there is substantial convergence across states once Chin and Rakhine are excluded from the sample. The clear implication is that while most states have begun to catch up, resulting in a gradual narrowing of regional inequality, Chin and Rakhine have been left behind in the convergence process. The subsequent section explores convergence dynamics in more detail at the level of townships, and identifies a key factor–infrastructure–that may moderate the convergence rate and explain why these states have failed to enjoy the broad-based, progressive income growth that characterizes the rest of Myanmar.

Figure 8: State-level convergence





4 TOWNSHIP CONVERGENCE

4.1 Estimation

I estimate standard growth regressions of the following form, for township *i* in year *t*:

$$\log(\tilde{y}_{it})-\log(\tilde{y}_{it-\tau})=\alpha+\beta \log(\tilde{y}_{it-\tau})+\lambda_s+\varepsilon_{it} \qquad (3)$$

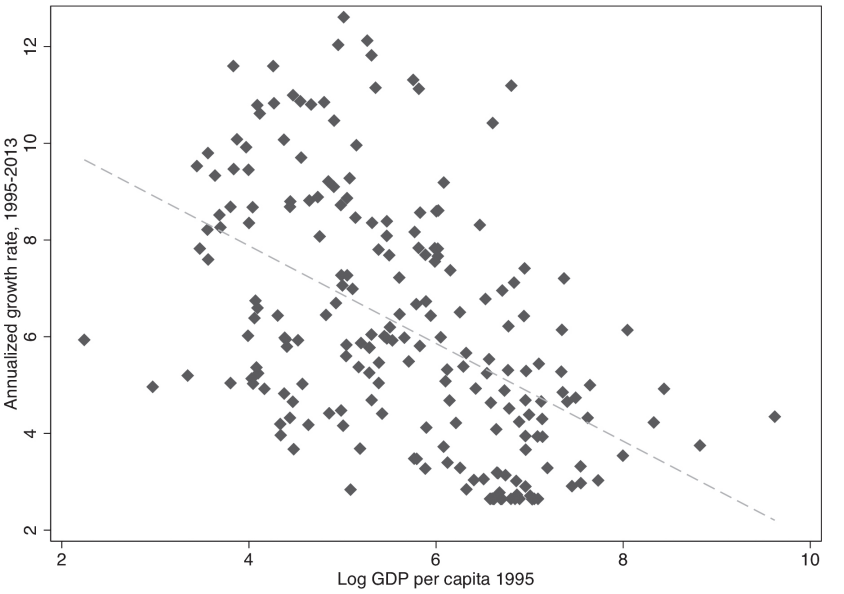
Where $\log(\tilde{y}_{it})-\log(\tilde{y}_{it-\tau})$ is the lights-predicted annualized income growth rate over the period $[t,\tau]$, and $\log(\tilde{y}_{it-\tau})$ is the lights-predicted level of income in the base year t-τ. To obtain the left hand side, I simply take the coefficients from the differenced specification in equation 2 and apply them the log difference of light density at the township level. I then annualize the compound growth rate over the period in question so that the units are in percentage points of average annual GDP growth. To obtain the right hand side (initial income per capita), I follow a similar method to Bundervoet et al. (2015). I use the projection from equation 1 to predict national income in year t-τ , that is, $\tilde{Y}_{t-\tau}$. I then distribute national income to each township *i* in proportion to its share in national lights and divide by the total township-level gridded population to obtain the per capita variable.

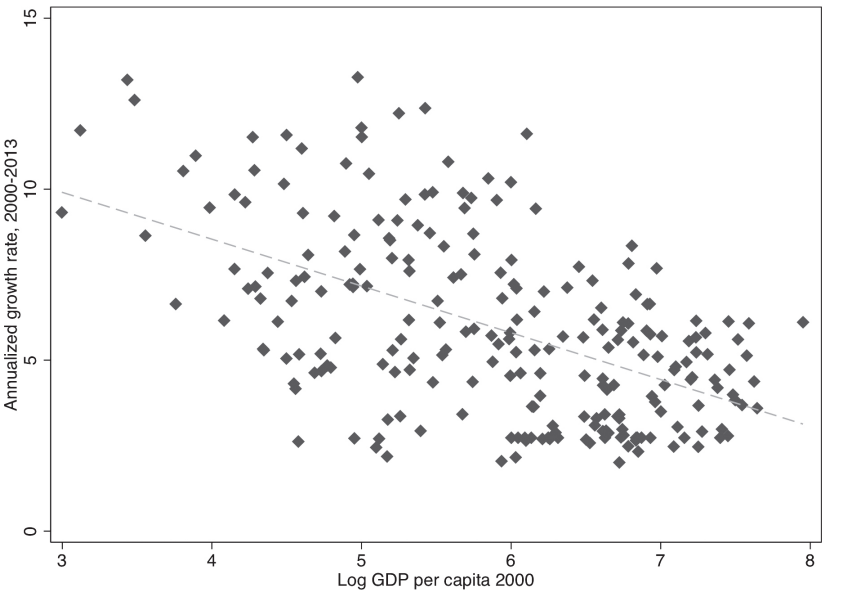
λ_s is a state-level fixed effect. When it is omitted from equation (3), we test whether there is evidence of unconditional convergence, on average, across townships. However, I also consider whether the convergence relationship holds among townships within a state, i.e. whether it is robust to the inclusion of state fixed effects. In absence of good data on township-level characteristics, this specification approximates a standard conditional convergence equation. It also tells us whether any unconditional convergence effect is driven by a few high-growth townships within poorer regions, or whether in fact it also holds broadly within any given region as well.

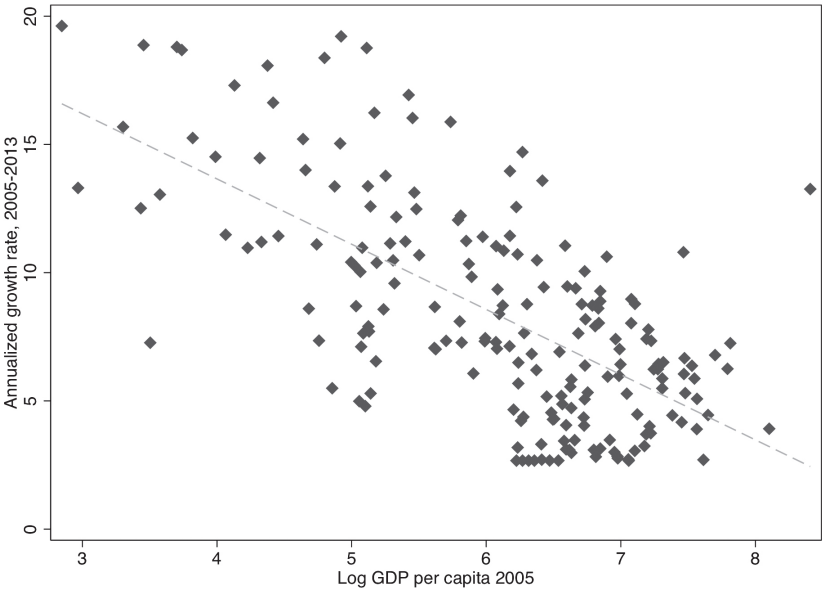
4.2 Baseline results

The results are presented graphically in Figure 9 and as estimates in Table 3. In order to minimize the role of outliers, I trim the outcome variable at the 5th and 95th percentiles, which substantially reduces the magnitudes of the estimated coefficients. Still, as the scatterplots demonstrate, there is a strong unconditional negative correlation between initial income per capita and subsequent growth. This correlation is evident in each period over which the growth rate is estimated, but particularly pronounced in the most recent period, 2005-2013.

Figure 9: Convergence across townships







Quantitatively, I find that a 1% increase in initial income per capita is associated with a 1.01 percentage point increase in the growth rate from 1995-2013, a 1.37 percentage point increase in the growth rate from 2000-2013, and a 2.54 percentage point increase in the growth rate from 2005-2013. All of these estimates are statistically significant at the 1% level, with standard errors clustered at the state-level to adjust for within-state correlation in income growth and levels. The estimates reveal that the convergence rate is monotonically increasing over time, suggesting that the faster national growth observed in more recent periods has not come at the cost of increased regional inequality. Instead, faster growth has been accompanied by ever greater convergence, and thus a faster pace of narrowing in subnational inequality. Interestingly, the explanatory power of initial income has also increased over time. The estimates are remarkably close to Barro's "iron law" of 2% convergence (Barro 2015), an empirical regularity across numerous cross-country growth studies.[7]

The inclusion of state fixed effects does not change the estimates over 1995-2013, and leads to a marginal reduction in the magnitude of the estimated coefficient from 2000 afnd 2005-2013. Since we observe strong convergence both across and within states and regions, this suggests that a few high-performing townships in poor states are not driving the results, since the results hold both within and across states. This intuition is visible in the scatterplots of Figure 9, which display

7 Though it should be noted that the iron law in the cross-country empirical literature refers to conditional convergence estimates.

an increasingly tight fit, which does not appear to be driven by outliers or influential observations. We observe the same trend in the R^2 , which rises from 0.247 to 0.435 from 1995 to 2005. Thus, it does not appear again that certain high-performing townships are driving the result. Rather, it appears to be a generalized phenomenon across all townships.

Table 3: Main convergence estimates

Period	1995-2013		2000-2013		2005-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Predicted log GDP	-1.010***	-1.024***	-1.368***	-1.340***	-2.544***	-2.197***
per capita	(0.174)	(0.129)	(0.217)	(0.158)	(0.268)	(0.188)
State fixed effects	No	Yes	No	Yes	No	Yes
Observations	211	211	232	232	194	194
R^2	0.247	0.482	0.289	0.494	0.435	0.593

Standard errors are clustered at the state/region level. Dependent variable is annualized average growth derived from the long difference estimates of equation (2). Predicted log(GDP per capita) is measured at the initial year of the long difference. *** p<0.01, ** p<0.05, * p<0.1

4.3 Robustness

The main results have several additional caveats that are worth investigating. As noted previously, the presence of measurement error in the lights data may lead to an underestimation of income levels in rural areas and growth in urban areas. In particular, the latter fact may overestimate the convergence rate, if we observe slower growth in initially richer urban areas as an artefact of top-coding and light saturation. To investigate this problem, I split the sample into urban and rural townships, as defined by above and below median population density in the base year. I then estimate separate growth regressions for each of these subsamples, trimming again at the 5th and 95th percentiles of the outcome variable. I compare the coefficients in Table4. Across all specifications, the estimated coefficients are nearly identical to those in Table 3 and not materially different in the urban or rural subsamples. Thus, it does not appear that the results are affected by the existence of systematic measurement error in the lights-income relationship.

I conduct several additional robustness tests, all of which confirm the original results.[8] Firstly, I test whether top-coding plays a particularly important role in Yangon and Mandalay, the areas of the country most likely to include saturated pixels. I re-estimate the unconditional and fixed effects models without Yangon and Mandalay in the sample, and obtain nearly identical results.

8 For brevity, these results are not reported here, but are available upon request.

Table 4: Split-sample estimates

Period	1995-2013		2000-2013		2005-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Urban			
Predicted log GDP	-0.972***	-1.035***	-1.473***	-1.391***	-2.569***	-2.093***
per capita	(0.177)	(0.138)	(0.237)	(0.244)	(0.278)	(0.169)
State fixed effects	No	Yes	No	Yes	No	Yes
Observations	142	142	141	141	123	123
R^2	0.295	0.514	0.386	0.55	0.48	0.659
			Panel B: Rural			
Predicted log GDP	-0.872***	-1.027**	-1.249***	-1.616***	-2.521***	-2.558***
per capita	-0.209	-0.295	-0.219	-0.284	-0.358	(0.425)
State fixed effects	No	Yes	No	Yes	No	Yes
Observations	72	72	90	90	71	71
R^2	0.155	0.444	0.217	0.471	0.403	0.535

Standard errors are clustered at the state/region level. Dependent variable is annualized average growth derived from the long difference estimates of equation (2). Predicted log(GDP per capita) is measured at the initial year of the long difference. Urban and rural are defined as above and below median population density in the initial year. *** p<0.01, ** p<0.05, * p<0.1.

Another non-trivial issue is that the log transformation required for the estimation of the income-lights function is undefined for all townships that do not have any lights, and thus these townships are dropped from the estimation. This explains the relatively small sample sizes in Table 3, despite the fact that there are 330 townships in the data.[9] These missing townships are disproportionately concentrated in Rakhine and Chin states; in 2005, for example, every township in Chin records no lights, and over half of the townships in Rakhine are missing. Other states with high proportions of missing values are Ayeyarwaddy and Sagaing, both with nearly half of all townships missing. To the extent that these extremely poor townships may also fail to catch up, excluding them will certainly overestimate the convergence rate. To deal with this issue, I follow the approach of Pinkovskiy (2013) and estimate a nonlinear income-lights function that allows for missing values by transforming light density as log(1+*lights*), and estimating the relationship with nonlinear least squares.[10] I then re-transform the predicted values of log of GDP density into logs and levels of GDP per capita, and calculate the appropriate growth rates directly from the predicted outcome variable rather

9 In particular, township-level lights are equal to zero for 84 townships in 1995, 61 in 2000, and 108 in 2005

10 In particular, using the WDI country panel dataset, I model the lights-income relationship as

$$\log\left(1+\frac{Y_{it}}{km_{it}^2}\right)=\alpha+\log\left(1+\beta\frac{NL_{it}}{km_{it}^2}\right)+\varepsilon_{it}$$

than from a long difference model. The transformation of light density means that log differences no longer have the interpretation of growth rates, and thus this specification is not appropriate. Additional diagnostic tests (not included available on request) indicate that this method achieves a weaker fit of levels and growth rates than the primary specification, but still provides a relatively good cross-country fit (the R^2 is around 0.72 in any given country cross-section). Most importantly, re-estimating the convergence model using this method includes the full township sample, but does not substantially change the results. If anything, the magnitudes of convergence coefficients actually increase slightly.

4.4 The role of infrastructure

Since one key assumption of neoclassical growth theory is that factors of production are perfectly mobile and therefore marginal returns can be equalized across the economy, the accounting for frictions in factor mobility should affect the convergence rate. In particular, townships that are initially endowed with better transport infrastructure should experience faster convergence, and transport infrastructure itself should also be positively correlated with growth rates after conditioning on income. I measure access to infrastructure as the log of the length of roads, rail, or rivers in a given township. In Table 5, I re-estimate the main convergence specification including the infrastructure variables. I estimate all models with state fixed effects over the 2005-2013 period, and include controls for area and population so that the marginal effect of additional infrastructure on growth can be interpreted conditional on township size.

Table 5: Estimates for 2005-2013 long difference, infrastructure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Predicted log GDP	-2.92***	-2.92***	-2.90***	-2.87***	-2.88***	-2.91***	-2.88***
per capita	(0.23)	(0.23)	(0.24)	(0.22)	(0.23)	(0.23)	(0.21)
Log(1+major							
road	0.55*	0.56*	0.55*				
length)	(0.29)	(0.29)	(0.28)				
Log(1+secondary road		-0.03					
length)		(0.19)					
Log(1+tertiary road			0.08				
length)			(0.18)				
Log(1+total road				0.83**			0.76**
length)				(0.34)			(0.34)
Log(1+rail length)					0.17		0.19
					(0.16)		(0.21)
Log(1+river length)						0.34	0.36*
						(0.22)	(0.18)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210	210	210	210	210	210	210
R^2	0.754	0.754	0.754	0.758	0.741	0.746	0.766

Standard errors are clustered at the state/region level. Dependent variable is annualized average growth derived from the long difference estimates of equation (2). Predicted $\log$(GDP per capita) is measured at the initial year of the long difference. Roads and railways are measured as of 2010. Controls are township area and population. All models include state/region fixed effects.

Firstly, the results of this estimation reveal that including infrastructure and additional township size controls does not fundamentally alter the convergence relationship observed in the main estimates. More interestingly, the presence of infrastructure, conditional on township income, size, and state fixed effects, does seem to have an independent association with the growth rate. Roughly, an additional 1% increase in the length of major roads is associated with a 0.55 percentage point increase in the growth rate. Interestingly, there is no additional effect of secondary and tertiary roads once major roads have been accounted for. When I sum the total road length, we find that an additional 1% increase in the total road length is associated with a 0.83 percentage point increase in the growth rate, significant at the 5% level. Interestingly, rail does not seem to have a significant independent association with growth, though it does have a marginally significant unconditional bivariate relationship with (b=0.58, significant at the 10% level).

More interesting for our purposes, however, is the question of whether the presence of infrastructure affects not just the level of growth, but the rate of convergence. To understand this, I estimate

$$\log(\tilde{y}_{it}) - \log(\tilde{y}_{it-\tau}) = \alpha + \beta_0 Infr_i + \beta_1 \log(\tilde{y}_{it-\tau}) \times Infr_i + \beta_2 \log(\tilde{y}_{it-\tau}) + \lambda_s + \varepsilon_{it} \quad (4)$$

Where $Infr_i$ is a dummy variable indicating the presence in township *i* of a major road, rail, or river, depending on the model. Note that this is a time invariant measure, which captures the existence of infrastructure as of 2011, since this is the only available data provided by MIMU. While there may be some concern that this variable is determined during the period of study, and thus may be subject to a simultaneity bias, this is only a major concern if a substantial changes in physical infrastructure occurred from 2005-2011. For rail and rivers, this is unlikely to be a concern, while for roads it may be a nontrivial issue. Since this is not testable, the estimates should be interpreted with some caution.

The estimates in Table 6 indicate that infrastructure plays an important role in moderating the convergence rate. For each regression, I center the GDP per capita variable around its mean such that the coefficient on the dummy indicating the presence of infrastructure is the effect of infrastructure on growth for the mean-income township. The results of column 1 confirm that having access to a major road is associated with an increase in the growth rate for the mean township of 1.3 percentage points. Interestingly, townships with no major road converge at a rate of -1.58, while townships with road infrastructure converge nearly twice as fast. Because of large standard errors, the estimates are not significant, however the results provide suggestive evidence that access to major roads increases the speed of convergence. The results are more convincing in column (2) for access to rail, which increases the speed of convergence from 2.1 to 3.25, a nearly 55% increase. This difference is statistically significant at the 5% level, and provides relatively compelling evidence of he importance of rail transport in reducing frictions in factor mobility that might inhibit convergence. Finally, in column (3), we find no evidence that waterways are important in moderating the speed of convergence.

Table 6: Interaction estimates for 2005-2013 long difference, infrastructure

	(1)	(2)	(3)
Predicted log GDP per capita	-1.58	-2.10***	-3.03***
	(1.07)	(0.45)	(0.34)
Any major road	1.30*		
	(0.65)		
Predicted log GDP per capita × Any major road	-1.41		
	(1.02)		
Any rail		-0.03	
		(0.76)	
Predicted log GDP per capita × Any rail		-1.15**	
		(0.5)	
Any river			1.09
			(0.74)
Predicted log GDP per capita × Any river			0.16
			(0.51)
State fixed effects	Yes	Yes	Yes
Observations	210	210	210
R^2	0.749	0.753	0.746

Standard errors are clustered at the state/region level. Dependent variable is annualized average growth derived from the long difference estimates of equation (2). Predicted log(GDP per capita) is measured at the initial year of the long difference. Roads and railways are measured as of 2010. Controls are township area and population. All models include state/region fixed effects. *** p<0.01, ** p<0.05, * p<0.1

4.5 The role of trade in border states

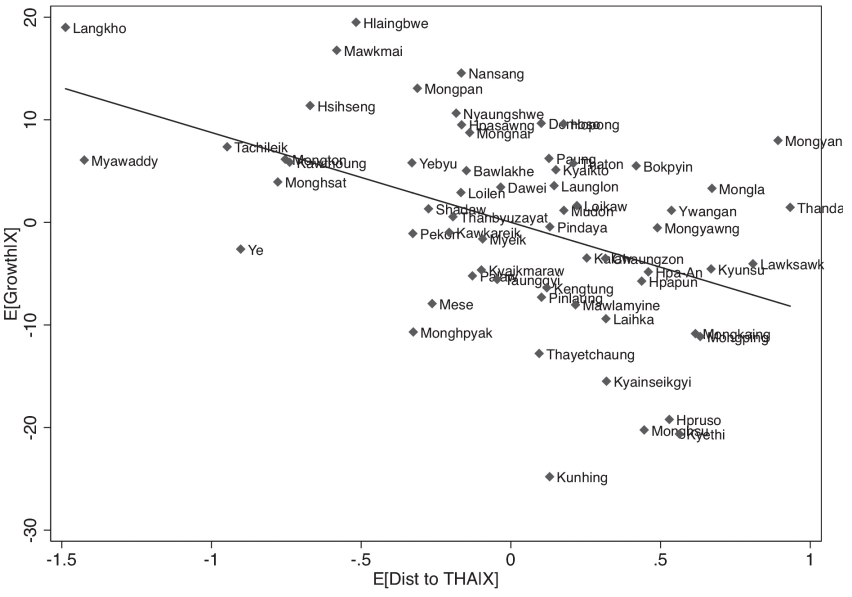
A substantial subset of the cross-country convergence literature has considered the question of whether international integration encourages income convergence. In a standard neoclassical framework, greater mobility of goods and capital across countries should increase the rate of convergence, while knowledge and technology spillovers may disproportionately benefit lower income countries. In the context of subnational convergence, the role of international integration is less clear. The benefits of cross-border trade may accrue largely in trading hubs that are initially better off. However, if greater border trade is accompanied by with increased access to export markets, it may promote positive spillovers to more remote locations in border regions. The extent of these spillovers depends critically on the existence of linking infrastructure, as well as the market power of middlemen along the supply chain.

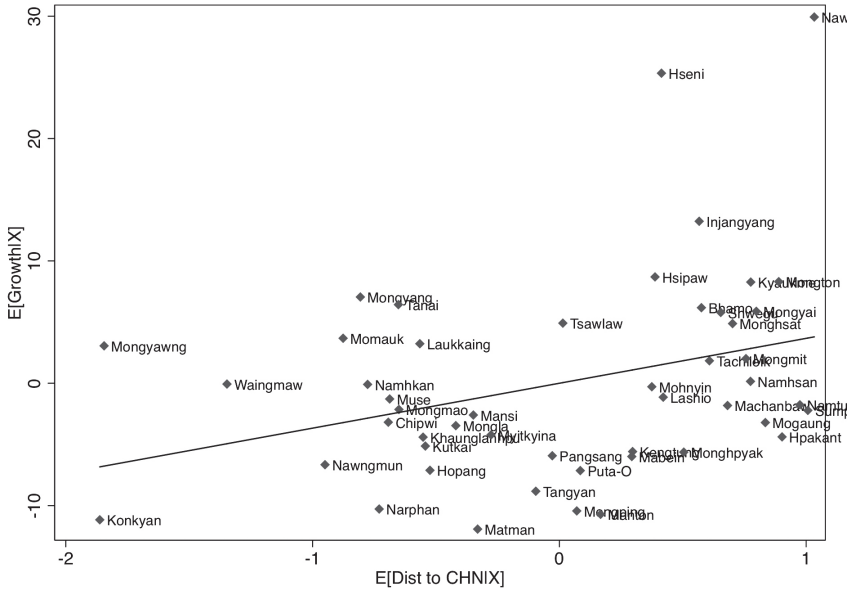
Table 7: Estimates for 2005-2013 long difference, border trade

Sample	Thai border states		Chinese border states		Indian border states		Rakhine state		Coastal states	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log(GDP per capita)	-3.89***	-7.98***	-0.98	4.23	-2.77***	7.68	-2.46	26.78	-2.22***	-4.06***
	(0.49)	(1.67)	(0.89)	(3.53)	(0.80)	(7.43)	(2.60)	(26.34)	(0.42)	(0.66)
Log(Distance to	-3.86***	-3.72***								
Thailand border, km)	(1.17)	(0.85)								
Log(GDP per capita)		1.10**								
× Log(Distance to Thailand border, km)		(0.43)								
Log(Distance to			1.81*	1.41						
China border, km)			(0.98)	(1.22)						
Log(GDP per capita)				-1.29						
× Log(Distance to China border, km)				(0.76)						
Log(Distance to					1.60***	1.49***				
India border, km)					(0.40)	(0.46)				
Log(GDP per capita)						-1.97				
× Log(Distance to India border, km)						(1.37)				
Log(Distance to							6.98***	10.89**		
Bangladesh border, km)							(2.10)	(4.92)		
Log(GDP per capita)								-5.99		
× Log(Distance to Bangladesh border, km)								(5.68)		
Log(Distance to									0.77*	1.49***
coast, km)									(0.39)	(0.36)
Log(GDP per capita)										0.70***
× Log(Distance to coast, km)										(0.20)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Observations	31	31	35	35	32	32	17	17	74	74
R^2	0.900	0.921	0.456	0.558	0.738	0.766	0.387	0.466	0.699	0.744

Standard errors are clustered at the district level. Dependent variable is annualized average growth derived from the long difference estimates of equation (2), except for columns 7 and 8 (Rakhine sample), where non-linear least squares estimates are used because of the small sample and many missing values. Predicted log(GDP per capita) is measured at the initial year of the long difference and centered around the subsample mean. Controls are township area and population. All models include state/region fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Figure 10: A tale of two borders, 2005-2013





Therefore, we might expect border trade convergence effects to be heterogeneous across the country, depending on the extent of border integration, the degree of market linkages to remoter areas, and the particular structure of border trade in certain regions. I test the importance of cross-border trade in Table 7 by augmenting the standard convergence equation with interactions of distance to borders with the initial (2005) level of log GDP per capita. This allows us to estimate whether convergence effects vary systematically with distance to the border. The logic that motivates distance to the border specification is that townships nearer to borders have lower transaction costs with respect to cross-border trade. Thus, if there is a border-trade convergence effect, we expect to observe it in initially poor areas nearer to borders.

Table 7 provides the results of this exercise. I divide the sample into different border regions[11] and run subsample regressions to estimate the growth and convergence effects of distance to the relevant border. However, this has the important effect of reducing the sample size substantially for each model. Figure 10 summarizes key results for the Chinese and Thai cases, arguably the most important border regions in Myanmar. Conditional on state fixed effects and controls, distance to the Thai border is negatively correlated with growth while the opposite pattern emerges with distance to the Chinese border. In other words, being nearer to Thai border is associated with faster growth, while being nearer to the Chinese border is associated with slower growth.

11 Thai border states are Shan (East), Shan (South), Tanintharyi, Mon, Kayin, and Kayah. Chinese border states are Shan (East), Shan (North) and Kachin. Indian border states are Chin, Sagaing, and Kachin

What about convergence effects? The Thai border effects seem to improve the speed of convergence (Table 7, column 2): each 1% increase in the distance from the Thai border is associated with a 1 percentage point reduction in the convergence rate. In contrast, there is no significant effect of distance on convergence in the Chinese case (Table 7, column 4), though the sign is of the opposite direction. This suggests that in Chinese border states, the townships that have converged are not those in the border regions, but rather those closer to the country's heartland. Equivalently, the Chinese border townships that have experienced substantial growth are the initially well-off, rather than the poor. There appear to be limited trade spillovers to poorer townships along the Chinese border, while such spillovers are present along the Thai border. In fact, the coefficients on log(GDP per capita) in models 2 and 4, which give the convergence effect exactly at the border, reveal that at the Thai border convergence rates are very high (7.98%), while at the Chinese border there is actually divergence at 4.23%, though the latter is not statistically significant.

At the Indian and Bangladeshi borders a similar pattern emerges. Being closer to the Indian border reduces both growth rates and convergence rates for border states. This is not entirely surprising, since there are very few cross-border trading posts along this border, and it encompasses extremely remote and mountainous regions in Sagaing, Chin, and Kachin states. Additionally, in Rakhine state, we observe the same coefficient signs with distance to the Bangladeshi border, again perhaps unsurprising given the well-known ethnic and sectarian violence that plagues Northern Rakhine state. Townships along Myanmar's western borders grow and converge faster if they are further from the border, less remote, and thus likely to benefit more from within-country market integration.

Finally, I analyse the convergence effects of maritime trade, as measured by distance to the coast in coastal states (Table 7, columns 9 and 10). Interestingly, distance to the coast is positively correlated with growth in coastal states, implying that on average inland areas of coastal regions have grown faster. However, with respect to income convergence, being 1% closer to the coast increases the convergence rate by 0.7%.

The results suggest that location with respect to trade matters for convergence in Myanmar, and that border effects are highly heterogeneous. Most interestingly, Thai trade appears to improve both growth and convergence, while the gains from Chinese trade are on average progressive. This may be because of higher rates of civil conflict in the Chinese border regions, or a lack of supporting infrastructure to generate market linkages for poorer border townships further from the primary trading hubs.

4.6 The role of within-country market integration

The natural next question is to more directly test an implication of the neoclassical view: whether within-country integration affects the speed of convergence. In the theory, within-country market integration is likely to be unambiguously progressive, given that it facilitates the mobility of factors across areas. There are several potential mechanisms to convergence here, as increased factor mobility benefits poorer areas either through inward capital mobility or outward labor mobility (and thus an increase rural wages and in per capita income). Beyond standard mechanisms, being relatively more connected to dense urban areas may also produce growth and convergence spillovers through migration, market access, and demand externalities.

It is useful, then, to compare the relative benefits of within country integration to those of border trade and integration with neighboring countries. As in the previous section, I measure I proxy integration by market distance or transaction costs, using distance to the three major cities in Myanmar (Yangon, Mandalay, and Naypyitaw). As with the trade analysis, while this measure does not allow for us to test between any of the convergence mechanisms (i.e. migration, market access, capital mobility, demand spillovers), it does allow for the estimation of a reduced form effect. To estimate, I augment the baseline convergence equation with the interaction of log GDP per capita in 2005 with log distance to these three cities.

Table 8: Estimates for 2005-2013 long difference, within-convergence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Central States									
Log(GDP per capita)	-3.62***	-3.58***	-3.70***	-3.67***	-3.71***	-3.86***	-3.71***	-3.83***	-3.57***
	(0.39)	(0.33)	(0.38)	(0.32)	(0.38)	(0.38)	(0.36)	(0.32)	(0.28)
Log(Distance to	-2.07	-0.99							-7.18
Yangon, km)	(3.12)	(3.35)							(4.24)
Log(GDP per capita)		0.71*							2.72
× Log(Distance to Yangon, km)		(0.35)							(1.57)
Log(Distance to			0.02	0.45					-2.40
Mandalay, km)			(0.59)	(0.77)					(1.74)
Log(GDP per capita)				-0.37					2.03
× Log(Distance to Mandalay, km)				(0.26)					(1.31)
Log(Distance to					-2.57*	-2.63*			-3.35**
Naypyitaw, km)					(1.36)	(1.34)			(1.49)
Log(GDP per capita)						0.90			0.85
× Log(Distance to Naypyitaw, km)						(1.05)			(1.30)
Log(Distance to							1.61	2.16**	3.75
coast, km)							(0.99)	(1.00)	(2.21)
Log(GDP per capita)								0.76**	1.15*
× Log(Distance to coast, km)								(0.34)	(0.65)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	61	61	61	61	61	61	61	61	61
R^2	0.869	0.878	0.866	0.872	0.877	0.878	0.871	0.879	0.919
Panel B: Border States									
Log(GDP per capita)	-2.96***	-2.96***	-2.99***	-3.25***	-2.99***	-2.80***	-2.94***	-2.91***	-2.98***
	(0.53)	(0.54)	(0.54)	(0.46)	(0.56)	(0.44)	(0.57)	(0.52)	(0.37)
Log(Distance to	-4.94**	-5.87**							-2.35
Yangon, km)	(2.42)	(2.63)							(5.05)
Log(GDP per capita)		1.91							-0.06
× Log(Distance to Yangon, km)		(1.35)							(1.92)
Log(Distance to			-2.96**	-3.06**					-2.81**
Mandalay, km)			(1.42)	(1.34)					(1.13)
Log(GDP per capita)				0.57**					0.50
× Log(Distance to Mandalay, km)				(0.23)					(0.65)
Log(Distance to					-3.06	-3.36			0.33
Naypyitaw, km)					(2.40)	(2.22)			(3.97)
Log(GDP per capita)						2.04*			2.49
× Log(Distance to Naypyitaw, km)						(1.06)			(1.96)
Log(Distance to							-1.01	-1.13	-1.48
coast, km)							(0.79)	(0.81)	(0.91)
Log(GDP per capita)								-0.11	0.45
× Log(Distance to coast, km)								(0.15)	(0.44)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	91	91	91	91	91	91	91	91	91
R^2	0.696	0.716	0.705	0.714	0.692	0.736	0.685	0.686	0.770

Standard errors are clustered at the district level. Dependent variable is annualized average growth derived from the long difference estimates of equation. Predicted log(GDP per capita) is measured at the initial year of the long difference. All variables are centered around their subsample means. Controls are township area and population, and state/region fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 8 provides the results. I split the sample between border states and central states,[12] a division which roughly captures potential geographical heterogeneity in the effect of distance. This heterogeneity is theoretically ambiguous–it may be that border states benefit more from integration with the center than states in the country's heartland. This certainly seems plausible, given the results showing that many townships bordering India, Bangladesh, and China all experience slower growth and convergence (Table 7). However, if central states are more connected by key infrastructure, they may be more likely to reap the benefits of proximity. In general, the evidence is more consistent with the former story–the hinterland benefits from proximity. Distance to Yangon has a large coefficient and the expected sign on both the level (column 1) and the interaction with initial GDP per capita (column 2) for border states (Panel B). Similar results for border states obtain with Mandalay—a major economic hub—particularly for northern and eastern border states of Shan, Kachin, and Sagaing. Distance to Mandalay is found to negatively correlate with both growth and convergence, both of which are significant at 5%.

However, for central states, while the signs are also consistent with positive within-integration effects, the magnitudes and significance are more muted. All coefficients are smaller for the Yangon model than in border sample, and only the convergence coefficient is significant at 10%. Proximity Mandalay seems to have a zero effect for the central states. Interestingly, distance to Naypyitaw has relatively similar effects in both subsamples, perhaps simply reflecting its geographic centrality in the country. The results make sense in a world in which transport costs are not a binding constraint to economic activity for states in the center, but are on the periphery. In this case, a marginal relaxation in the market access constraint is more important in more distant regions. In contrast, in the center, the costs of moving factors and output to and from major economic hubs aren't a binding friction. Interestingly, the results of Section 4.5 and 4.6 taken together suggest that on average, townships in remote parts of the country benefit more from integration with the center than with trade at the border. However, there may indeed be complementarities along either margins, since smaller towns can grow as trading hubs along local infrastructure lines that connect cities to the border. As an example, consider the towns along the roads that connect Mandalay to the Chinese border. While in theory all towns along this important trade route can benefit from trade, as of now it appears those gains have been concentrated nearer to Mandalay and further from the border.

12 Border states are Rakhine, Sagaing, Kayin, Shan, Tanintharyi, Kachin, Kayah and Mon. Central states are Mandalay, Bago, Magway, and Naypyitaw. Coastal states are Yangon, Ayeyarwady, Tatintharyi, Rakhine, and Mon

5 CONCLUSION AND POLICY IMPLICATIONS

The results presented here reveal several interesting facts about national and subnational growth in Myanmar. I replicate core findings from HSW, suggesting that even in a different country sample and over different time periods, night lights remain a robust predictor of income levels and growth. Importantly, the national growth and GDP estimates for Myanmar imply persistent overestimation of GDP levels and growth, though this gap has narrowed in more recent periods. Using optimal weights derived from HSW, the estimates imply a downward revision of GDP per capita annual growth rates from 9.9% to 7.08% over the 2000-2013 period, and from 8.77% to 7.8% over the 2005-2013 period.

Looking at state-level income and growth rates, the lights estimates identify several high-growth states, including Kayin, Mon, Bago, and Ayeyarwaddy. At the same time Chin, Tanintharyi, Magway, Rakhine, and Kachin remain laggards. Interestingly, the large urban centers of Yangon and Mandalay have experienced relatively average growth from 2005-2013, though we cannot rule out that top-coding in the lights series plays a role in underestimating growth rates in more urbanized areas. Importantly, at the state level we observe a relatively strong convergence pattern from 2005-2013 only when Chin and Rakhine are excluded from the sample. This suggests that convergence across states is not a fully generalized phenomenon, and that the country's two poorest states have not enjoyed the benefits of recent economic growth to the same degree as the rest of the country.

At the township-level, a more detailed picture emerges. Estimates of the unconditional convergence rate, and the convergence rate conditional on state fixed effects are relatively stable, with convergence increasing monotonically over time to approximately 2.5% in the 2005-2013 period. The convergence results are robust to several sources of measurement error in the night lights data, and do not appear to be driven by particular influential observations or the omission of very poor townships for which the log of lights variable is not defined. Finally, the convergence rate depends on the degree of internal frictions in factor mobility, as measured by the presence of physical infrastructure. Conditional on size, townships with a more extensive network of road and rail experience substantially faster convergence. Access to a major road nearly doubles the convergence rate, while access to a rail line increases the convergence rate by 55%. There are additional level effects of the length of roads on growth, though these are driven primarily by major roads rather than secondary and tertiary feeder roads. Finally, within-country integration seems to be more important than border trade in spurring growth and convergence. This is particularly true in border regions, while the Thai border is the only one that exerts a positive effect.

The results have important implications for subnational development policy in Myanmar. Firstly, the striking divergence between official data and lights-estimated income and growth highlights the need to improve measurement of macroeconomic indicators in Myanmar. While the lights do reveal that there has been substantial income growth in Myanmar even prior to the political transition of 2011, it is vastly overstated. However, the measurement biases in national accounts data appear to have decreased over time, with more recent growth rates conforming more closely to those predicted by night lights.

Secondly, despite the observed convergence, large state-level income gaps remain, so geographically targeted policy will still be needed. In particular, the results from the infrastructure estimation suggest that reducing mobility frictions in capital, goods, and labor markets can allow lagging regions to experience greater gains from growth. It is no coincidence that the areas of the country with limited access to the road and rail network remain poor, and have also been largely left behind in the convergence process. For example, townships without a major road do not experience significant convergence. The findings highlight the crucial role that spatial integration of markets plays in spreading the benefits of growth more evenly. This implies that if regional equality is a major policy goal for government, infrastructure projects with limited short-run economic viability may be desirable because of integration externalities that reduce spatial inequality. In addition, we must understand in greater detail why townships along most borders are not benefitting from border-trade related spillovers, whether because of conflict in Rakhine and Shan, poor infrastructure in Chin, or difficult terrain in Sagaing. The finding that connection to Mandalay, Yangon, and NPT matters most in border regions even further reinforces the need for connecting infrastructure to reduce transport costs at a given distance, relaxing a binding constraint to economic activity.

However, despite persistent inequities across both states and townships and the aforementioned substantial heterogeneity that convergence dynamics in Myanmar display, the overall trend has been strong unconditional convergence on average, both at state and township level, implying that recent growth in Myanmar has been largely progressive. Remarkably, the convergence estimates are stable across rural and urban areas, and persist both across and within states, and in the presence of numerous covariates. Therefore, there is justified optimism about the power of broad-based income growth to reduce regional inequality in Myanmar.

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PATH TO DIVERSIFICATION: ANALYSING MYANMAR'S PRODUCT SPACE, COMPLEXITY, AND IDENTIFYING FEASIBLE PRODUCTS

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SUMMARY

Myanmar's exports are greatly concentrated in mineral and agricultural products, as in many other developing countries. Reliance upon commodity products makes Myanmar vulnerable to both economic and political risks; hence, the phenomenon calls for the need to diversify Myanmar's export base. To do that, it is important to understand the country's productive structure in terms of services and goods. Operationalising concepts developed in product space and economic complexity literature – for instance, Hausmann and Klinger (2007), Hidalgo et al. (2007), and Hidalgo and Hausmann (2009), this study analyses Myanmar's productive structure. It finds that textiles, basic food products, and manufactured products, excluding the *most* complex manufactures, are the most feasible products with higher complexity and return for Myanmar to compete in the global market. Based on these findings, the study concludes with some policy suggestions for the role of policy makers in promoting these feasible products.

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1 INTRODUCTION

Export growth is important due to its impacts on the economy at both the macro- and micro- levels. At the macro-level, exports are one of the main sources of foreign income, vital for trade finance, the growth of national products and job creation. At micro-level, exports contribute to the productivity of domestic firms, as exporting firms are more efficient than non-exporting firms from international competition and associated positive spill-overs, including enhanced technical knowledge and better management styles, to such firms. Export growth for developing countries should be achieved through expanding upon their existing export basket since concentrating on a few product sectors/groups will make them more vulnerable to external shocks – both economically and politically, and sustained growth may not be achieved by specialisation in commodity products. Like many other developing countries, Myanmar relies heavily on a few primary sectors such as agriculture and mineral products which have a less sophisticated productive structure than manufactured products. Specialisation in such products will not improve Myanmar's export competitiveness; but would further expose the country to export instability due to the volatile nature of commodity prices. Hence, diversifying its export base is much needed for Myanmar to avoid external shocks and achieve sustained growth.

The importance of export growth is not ignored in the policy arena in Myanmar. Since opening up and its re-integration into the global economy in the early 2010s, the Government of Myanmar (with the support of development partners) has undertaken several trade-related studies[14] to identify bottlenecks, strategic product development, and link trade with development across other sectors. Policies favouring export growth are also highlighted in the 12-point economic policy of the current NLD administration and designed to continue economic reforms and drive the country's competitiveness. Such policies include:

- Policy No. 6, which indicates balancing agriculture and industry to enable increased exports.
- Policy No. 7, which notes formulating specific policies to increase foreign investment.
- Policy No. 12, which mentions identifying the changing and developing business environment in ASEAN and beyond[15].

14 For instance, Diagnostic Trade Integration Study (DTIS) by World Bank, Medium Term Program (MTP) by World Bank, National Export Strategy (NES) by ITC, and among others.

15 Government of Myanmar, 2016. The 12-point Economic Policy.

The vital role of exports is well-linked with each of the above policies. Enabling increased exports requires diversifying not just the product basket, but also the basket of likely markets. Foreign investment is also important for certain exports that are capital-intensive or technology-intensive (or both) as Myanmar needs to make more sophisticated products that demand more advanced capabilities. In addition, enabling export growth requires not just production capability, but also other factors such as quality infrastructure to ensure that Myanmar products meet the quality standards of importing countries. Similarly, improved logistics performance is critical for high-end market access. Hence, enabling increased foreign investment in trade related infrastructure will be beneficial in diversifying both in terms of products and markets for Myanmar's exports.

Relevant policies for export growth, which could be achieved through diversification, are thus laid out in the 12-point economic policy. Nevertheless, there is room for more analytical works on Myanmar export growth opportunities. Hausmann et al. (2007) claim what a country can produce today matters for tomorrow, as it can dictate where a country would stand in the future. Based on this view, Myanmar can improve its productive structure by developing more complex products, that are not far away from the current capabilities the country possesses. Accordingly, analysing the current productive structure can help identify the feasible products that Myanmar can produce, given its current capabilities. Employing concepts of complexity and product space developed by Hausmann and Klinger (2007), Hidalgo et al. (2007), and Hausmann and Hidalgo (2009), makes it possible to identify feasible products for diversifying Myanmar's export basket. Along with this, it is also important to understand the productive structure as it could help policy makers develop better trade and industrial policies.

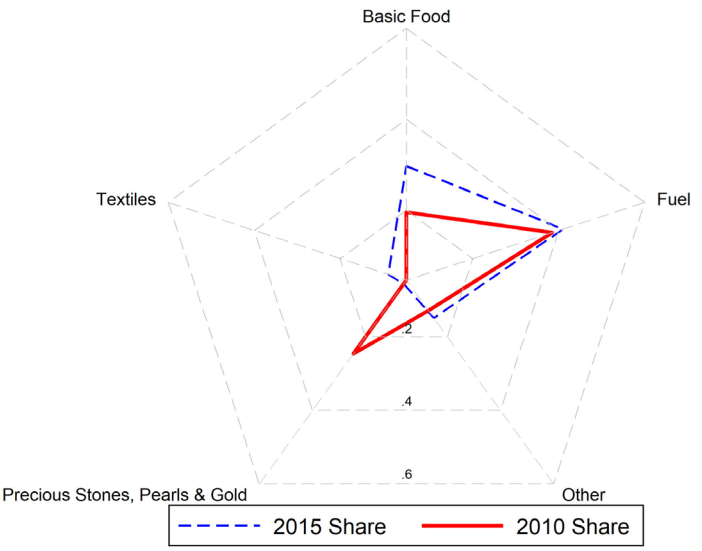
Hence, the objective of this study is to analyse the productive structure of Myanmar and to identify new products to diversify Myanmar's export base. The findings from this study will hopefully complement Myanmar trade related policies and strategies in bringing export growth. Along with the findings, this study also suggests policies to help produce feasible products. However, it is important to be mindful that this study does not formulate detailed strategies for diversification, which warrants considerable further study.

2 HOW DIVERSIFIED IS MYANMAR?

Using export data at SITC 4-digit level collected from the UN Comtrade database through World Integrated Trade Solution (WITS), this section analyses how diversified Myanmar's exports currently are. Myanmar's export basket is

concentrated in primary sectors[16] and is heavily dependent on a few major partners. In terms of product sectors, fuel dominated the export basket in 2015, a pattern that has not changed since 2010. On the bright side, the textile sector expanded its exports markedly between 2010 and 2015, and exports of precious stones, pearls and gold significantly shrunk in 2015. The latter taken as a positive sign of less reliance upon exports of products from extractive industries while fuels (mineral products) dominated the basket (see Figure 1). In fact, Gelb et al. (2017) document that garments took the leading role of exports in 2000, but the sector declined due to sanctions by the US and EU, imposed in the early 2000s. However, garment exports have increased since 2010 due to a combination of factors, including the expansion into Asian markets, the relaxation of sanctions by the US in 2012, and the EU's restoration of Generalized Scheme Preferences (GSP) in 2013.

Figure 1: Sectoral composition between 2010 and 2015



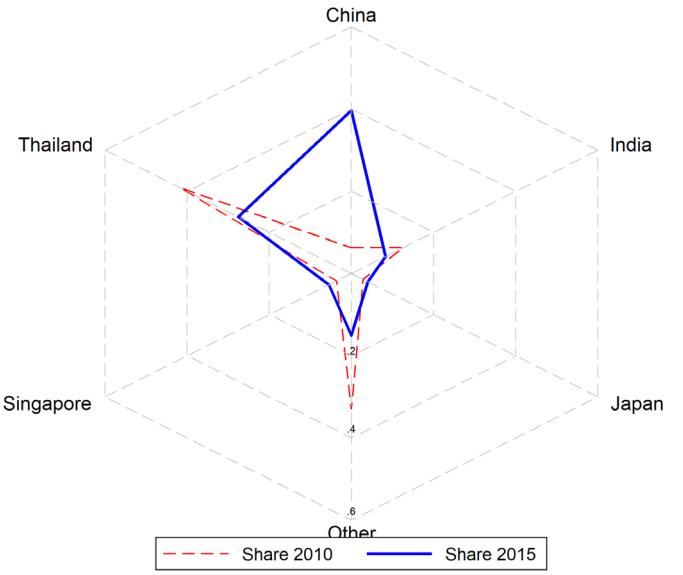
Source: Data from UNComtrade

Looking at market (or geographical) orientation, Myanmar's major trade partners are its neighbours. Worryingly, this includes a heavy concentration to just one country - Thailand in 2010 and China in 2015. China has become the top

16 Products are grouped according to UNCTAD classifications. See http://unctadstat.unctad.org/EN/Classifications/DimSitcRev3Products_DsibSpecialGroupings_Hierarchy.pdf

destination of Myanmar's exports, yet the data demonstrates that Myanmar's exports to other countries have reduced in recent years (see Figure 2). This indicates that the lifting of sanctions and the preferences granted by the EU and the US have not resulted in much effect yet, suggesting that the quality of Myanmar products has yet to meet the standards of those countries.

Figure 2: Market/Geographical Orientation between 2010 and 2015



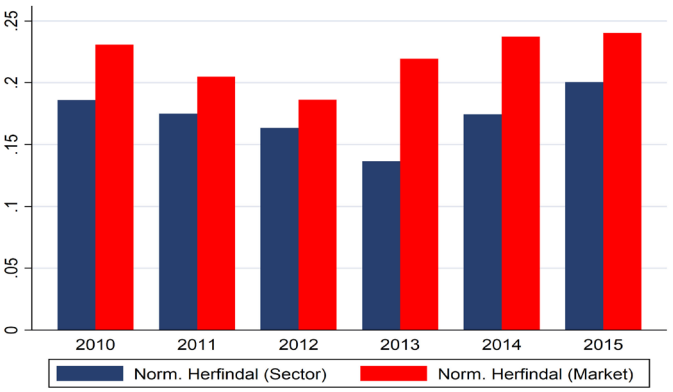
Source: Data from WITS-UNComtrade

Reliance on a few product sectors and markets could make Myanmar vulnerable to both external economic and political risks. In addition, Myanmar's policy makers need to be aware of the so-called "natural resource curse", a term coined by Auty (1993) to describe the phenomenon that countries endowed with rich natural resources tend to have slower economic growth than countries with less natural resources. This could happen due to the volatile nature of prices of natural resource products (such as mineral and agricultural products) in the world market, crowd-out effects of natural resource on the manufacturing sector, and macroeconomic instability brought about by volatile commodity prices. Political risks of natural resources also are said to exist; countries with abundance of natural resources are likely to have armed conflict (for instance, see Collier and Hoeffler (2005), Humphreys (2005)) with natural resources there for taking rather than investing in productivity-enhancing inputs such as labour and capital as in other sectors. Moreover, it could also have negative impacts on democracy, as countries endowed with rich natural resources rely taxes derived from

extractive industries to fund expenditure, cutting citizens out of their participatory and moderating role that grows on the back of generalised tax systems. Hence, citizens are crowded out in the decision-making process.

Empirical investigations of the natural resource curse are well established in the literature; for instance, Sachs and Warner (1995) document the strong negative relationship between economic growth and natural resource abundance. In fact, Myanmar has almost always relied on natural resources (as in Figure 1), hence, it is important for policy makers to diversify the economy to avoid this 'curse'. In addition, it will also impede the complexity and competitiveness of new Myanmar products in the global market. The recent incidence of India imposing an import quota on beans and pulses is a good example for the risk of over-dependency on a few markets. It is also inevitable for Myanmar to receive lower export earnings when Myanmar's top export destinations face economic downturns.

Figure 3: Myanmar's export concentration (Herfindahl Index)

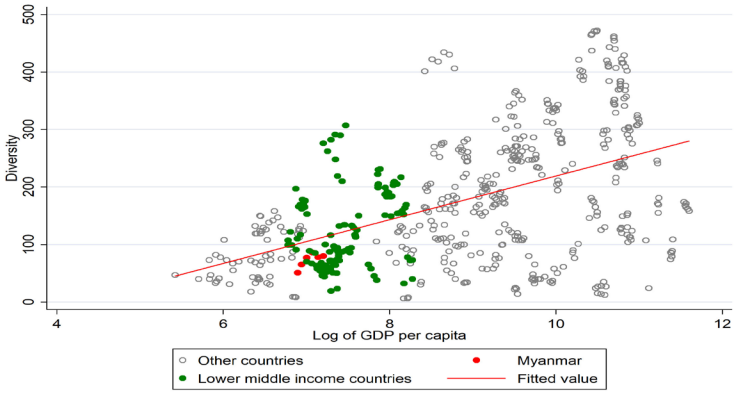


Source: Data from WITS-UNComtrade

Figure 3 shows Myanmar export concentration[17] between 2010 and 2015. Both market concentration and sectoral concentration shares show similar trends, with no significant changes between 2010 and 2015. In fact, Myanmar's product diversity (that is, the number of products that a country can export competitively) is below global average for its income level, and lower still than many other lower middle-income countries (see Figure 4).

17 Normalised Herfindahl index is used to observe concentration, and it is calculated by summing up squares of share of each sector (or market). Index value 1 indicates complete concentration in one sector or market, and 0 indicates least concentration.

Figure 4: Myanmar's product diversity is below average for its income (2010 – 2015)



Source: Data from WITS-UNComtrade and WDI

This study further discusses whether Myanmar's market orientation and sectoral composition of exports in 2015 are favourable. To examine if market orientation is favourable, a bivariate regression is run on import growth of Myanmar's destinations between 2010 and 2015 against the share of Myanmar's trade partners in 2015 export basket. Figure 5 shows that correlation to be negative, which indicates orientation is not favourable as more concentrated export destinations have slower import growth – which calls for the need of export market diversification as relying on destinations with slower import growth can clearly have negative effects on export growth of the country. This finding is in line with China's slower import growth from Myanmar in 2015. China, a major export destination of Myanmar, contributes much to world trade, indeed world's import volume growth in 2015 would be 2.1 per cent rather than the actual 1.7 per cent if China's merchandise import did not fall in 2015 (World Bank, 2016). China's slower import growth from Myanmar in 2015, and the recent import quota on beans and pulses imposed by India, calls for diversifying of Myanmar export market to avoid unfavourable impacts on export growth.

Figure 5: Market Orientation of Myanmar Exports in 2015

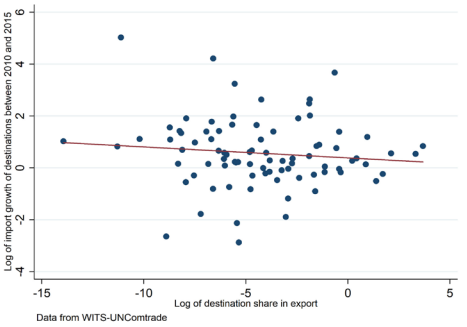
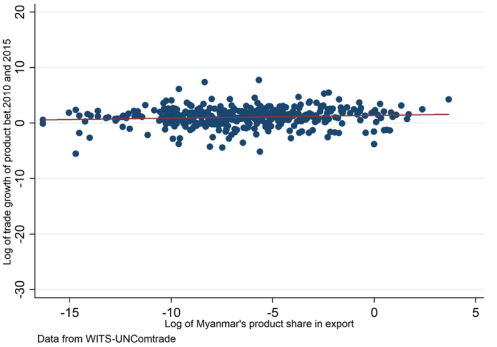


Figure 6: Product Composition of Myanmar Exports in 2015



A similar analysis is performed for sectoral composition – and a regression on trade growth of products in global markets between 2010 and 2015 is run against Myanmar's product share in its 2015 export basket, and a very weak positive slope line is observed (see Figure 6). In general, a positive slope is good for a country's product composition as it indicates that the country is positioning on fast growing products. In the case of Myanmar, however, it is not very accurate to say that it is positioning on fast growing products since the slope of this line is quite flat. Nonetheless, positive correlation is observed; that could be due to expansion in textile products, basic food products, and other more elaborate products recently. Analysing sectoral composition and market/geographical orientation suggests that Myanmar needs to diversity both its export markets and products to avoid or reduce unfavourable economic and political risks.

3 BRIEF REVIEW ON DIVERSIFICATION

Diversification is defined as adjusting shares of products in the existing export basket or adding new products to the export basket (Ali et al., 1991). The term diversification is not limited to expanding the export base by adding new products; it can be also applied to destinations/markets – exporting products to more and different destinations. Diversification can also take either horizontal or vertical dimensions. Horizontal diversification involves the adjustment of products in the export basket to hedge against economic risks (such as instability or decline in international prices) or political risks, and it could happen within the same sector of products. Vertical diversification involves creating additional uses for both current and new products through value-added activities such as processing, marketing and other services. It can help expand market opportunities for raw materials that could achieve growth and stability as processed materials tend to have more stable price than raw materials. In general, horizontal diversification is adding new products to an existing export basket (hence,

diversifying within sectors), while vertical diversification is producing products in a new sector (for instance, moving from raw exports to value-added exports). In addition to these two main dimensions of diversification, Samen (2010, p.4) mentions that diagonal diversification – which involves "a shift from imported input into secondary and tertiary sector" – is sometimes noted in the literature.

Within the tradition of classical economics and the introduction of the division of labour concept by Adam Smith, trade theories such as the Ricardian and Hecksher-Ohlin models suggest that countries should specialise in producing products over which they have a comparative advantage and facilitating resource endowments. Based on such theories, a country like Myanmar endowed with resources such as labour and land should specialise in primary commodities such as agricultural products, and exchange such products with other types of resource intensive products such as automobiles from other countries. This view was challenged by the Prebisch-Singer hypothesis, which argued that commodity prices tend to decline relative to manufactured good prices overtime, hence, developing countries specialising in commodities are subject to both short-term and long-term detrimental effects (Prebisch, 1950; Singer, 1950). Since then, the effects of diversification on economies have been investigated both theoretically and empirically.

Based on Prabisch-Singer hypothesis, vertical diversification from primary commodity to manufactures could be useful for developing countries to escape declining terms of trade. Hence, specialisation in commodity products may be the right strategy for developing countries to survive in modern international trade as it could make them vulnerable to external shocks due to heavy dependence on primary commodities – causing policy makers to face challenges in expanding export revenues, stabilising export earnings, in upgrading value-adding (Samen, 2010) and hampering competitiveness as a result of not being able to adapt structural transformation of the economy. To enable adapting structural transformation, Chenery (1979) and Syrquin (1988) argue that countries should diversify from primary commodities into manufactures to achieve sustainable growth, however, it would take certain time to diversify their economy vertically given their capability constraints. Another favourable argument for diversification is that diversifying away from primary commodities can help countries stabilise export earnings in the longer term as primary commodities are subject to price volatility (Ghosh and Ostry, 1994; Bleaney and Greenaway, 2001).

Diversification not only helps countries stabilise their export earnings and expand their product base, other positive spillovers of diversification on an economy are also documented in literature such as Matsuyama (1992), Amin Gutierrez de Pineres and Ferrantino (2000), and Al-Marhubi (2000). The vital role of learning-by-doing in the manufacturing sector for sustained growth is highlighted in

endogenous growth models such as Matsuyama (1992), as manufactured products can offer potential for sustained learning and more spillovers than other products. Diversification brings new techniques/knowledge for production, new management and new marketing practices, and better labour training which can benefit other industries through spillovers (Amin Gutierrez de Peneres and Ferrantino, 2000), and Al-Marhubi (2000).

The empirical evidence linking export diversification and growth/development is well-outlined in the literature – confirming the theoretical investigation of diversification on the economy. Cross-sectional studies by Al-Marhubi (2000), and De Ferranti et al. (2002) find that export diversification promote economic growth. In dynamic panel studies by Lederman and Maloney (2007), Agosin (2007) and Hesse (2008), export diversification is correlated with per capita income growth. Not just in panel and cross-sectional studies, within country studies by Amin Gutierrez de Pineres and Ferrantino (1997), and Herzer and Nowak-Lehmann (2006) claim that export diversification has been beneficial for economic growth of Chile. Similarly, Balaguer and Cantavella-Jordá (2004) found that structural transformation is positively linked to the economic growth of Spain. In Hausmann and Rodrik (2003), Hausmann, Hwang, and Rodrik (2007), and Hausmann and Klinger (2007), both theoretical and empirical frameworks on how diversification is beneficial for economic growth are presented.

Developing successful diversification policies, however, is not always easy as it requires a mix of different skills, capital and technology. Samen (2010) mentions that both horizontal and vertical diversification is required for sustainable long-term export growth as it is important to have a balanced export mix (i.e. adding new products in existing sectors), and to produce products with value-added (i.e. moving from raw commodity to value-added products). For short-term export growth, Myanmar could adapt a horizontal diversification approach as new products that share similar capabilities of current products. With capabilities developed through making new products by horizontal diversification strategy, Myanmar should aim to produce more sophisticated products along with a vertical diversification strategy.

4 METHODOLOGY

This study uses concepts developed in Hausmann et al. (2007), Hausmann and Klinger (2007), Hidalgo et al. (2007), Hausmann and Hidalgo (2009), and Hausmann and Hidalgo et al. (2011) to examine Myanmar's productive structure and explore potential products that could improve Myanmar's output complexity. The concept of complexity is briefly described, and construction of complexity indices are presented in subsection 4.1, while the concept of product space, and

the construction of related measures are presented in subsection 4.2. These concepts are operationalised by using export data at SITC 4-digit level collected from UN Comtrade database through World Integrated Trade Solution (WITS). To ensure as much export data as possible is included in this analysis, mirror data are used for countries which are not available as reporters. Finally, this study analyses the comparative advantage and complexity of Myanmar's output between 2010 and 2015, and identifies feasible products based on the most recent product basket, that is, the 2015 export basket.

4.1 Economic Complexity

The importance of productive structure of a country, which is a set of service and products that a country can produce and export, is highlighted in Hausmann et al. (2007), and Hidalgo and Hausmann (2009). The productive structure of a country cannot just explain its current level of growth but also predict its future growth. A country is said to have a productive structure if it can produce a set of complex products. Hidalgo and Hausmann (2009) present a simple theory that proposes local availability of highly specific inputs (or capabilities), which can be tangible or intangible, that determines the productive structure of countries. Examples of tangible capabilities are bridges, roads, and the like, and those of intangible capabilities are norms, skills and the like. The sophistication or complexity of a product is related to the set of capabilities which is required to produce that product, and the productive complexity of a country is related to the locally available set of capabilities.

The measures of product sophistication and country complexity used in this study are developed by Hausmann and Hidalgo et al. (2011)[18]. The concept of complexity is based on notions of diversity and ubiquity. Diversity is related to the number of products that a country's output is related to, and ubiquity is related to the number of countries that a product is related to. Otherwise, a country is said to have diversity if it can produce and export a number of products with comparative advantage, and a product is said to be ubiquitous if it requires few capabilities. Therefore, ubiquitous products are more likely to be produced by many countries, while only a few countries can produce less ubiquitous products. There is a negative relationship between diversity and ubiquity, as more diverse countries can make less ubiquitous products. And both of them are crude measures for how much capabilities that a country possesses. Accordingly,

18 Hausmann et al. (2007) first introduced how these measures can be quantified. To measure the sophistication of a product, an index called PRODY is developed – which is a weighted average of the per capita GDPs of countries exporting a given product, and represents the income level associated with that product. Likewise, an index called EXPY is constructed to measure complexity of a country, which is a weighted average of the PRODY for that country, where the weights are the value shares of the products in the country total exports.

they are not perfect measures as the case of diamond and other natural resource related products amply illustrates. For instance, a few countries can produce diamonds or other natural resources products, but it does not imply diamonds are complex or countries that produce diamonds are complex – in fact, it is rather a geographic lottery.

To address such instances, diversity can be used to correct information carried in ubiquity, and ubiquity can be used to correct information carried in diversity. This correction process can be iterated infinitely – called the method of reflection. Through this correction, complexity indices for country and product are created. For countries, such are called "Economic Complexity Index" (ECI), and for products, it is called the "Product Complexity Index" (PCI). The ECI measures the amount of productive capabilities of a country, and the PCI measures the amount of productive capabilities required to produce a product. A high ECI index indicates that a country is well diversified and able to produce products with high PCI value. Likewise, a high PCI index indicates that a product requires high capabilities to produce, and only countries with high ECI can produce it. Hausmann and Hidalgo et al. (2011, p.24) present a mathematical formulation of these indices as follows:

$$Diversity = K_{c,0} = \sum_{p} M_{cp} \quad (1)$$

$$Ubiquity = K_{p,0} = \sum_{c} M_{cp} \quad (2)$$

where c and p denote country and product respectively, and M_{cp} is defined as a matrix of 1 if country c produces product p, and 0 otherwise. Diversity and ubiquity are measured by summing over rows or columns of that matrix.

As mentioned previously, diversity can be used to correct information carried in ubiquity, and vice versa. For countries, it is required to calculate the average ubiquity of the country's c products that it exports, and average diversity of those countries producing those products. For products, it is required to calculate average diversity of the countries that make them, and the average ubiquity of other products that these countries make. This can be expressed by the recursion:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_{p} M_{cp}\, k_{p,N-1} \quad (3)$$

$$k_{p,N} = \frac{1}{k_{p,0}} \sum_{c} M_{cp}\, k_{c,N-1} \quad (4)$$

insert equation (4) into (3), then

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_p M_{cp} \frac{1}{k_{p,0}} \sum_{c'} M_{c',p} \, k_{c',N-2} \quad (5)$$

$$k_{c,N} = \sum_{c'} k_{c',N-2} \sum \frac{M_{cp} M_{c'p}}{k_{c,0} k_{p,0}} \quad (6)$$

that can be rewritten as

$$k_{c,N} = \sum_c \widetilde{M}_{cc} \, k_{c,N-2} \quad (7)$$

$$\widetilde{M_{cc}} = \sum_p \frac{M_{cp} M_{c'p}}{k_{c,0} \, k_{p,0}} \quad (8)$$

Equation (8) is satisfied when $k_{c,N}$=$k_{c,N-1}$=1 . This is the eigenvector of $\widetilde{M_{cc}}$ associated with the largest eigenvalue – which is not informative as this eigenvector is a vector of ones. Instead, eigenvector associated with the second largest eigenvalues is taken as it captures the largest amount of variance in the system, and it is the measure of economic complexity index (ECI). Hence, it is defined as:

$$EC = eigenvector \ associated \ with \ \ the \ second \ largest \ eigenvalue \ of \ \widetilde{M_{cc}} \quad (9)$$

Produce complexity index (PCI) can be defined as the way ECI is defined. The construction of PCI can be simply done by exchanging the index of countries *c* with that of products *p* in the construction of ECI above due to the symmetry of the problem.

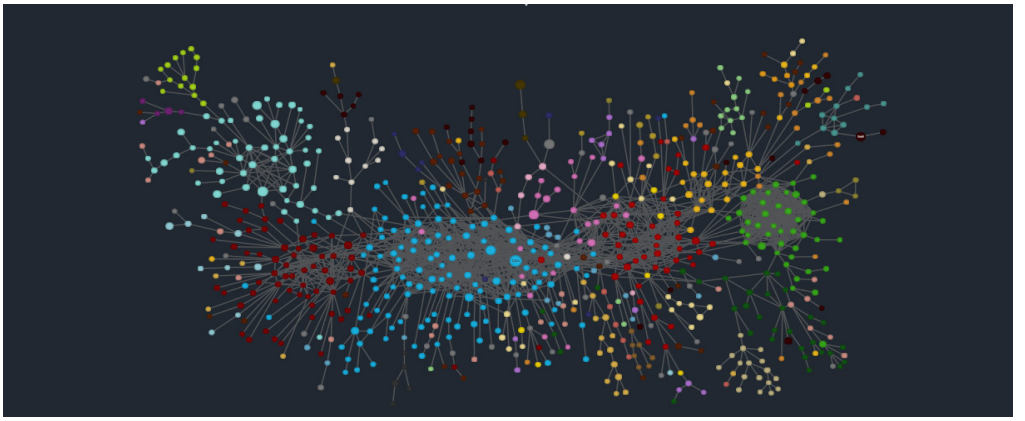
Hence, PCI is defined as:

$$PCI = eigenvector \ associated \ with \ \ the \ second \ largest \ eigenvalue \ of \ \widetilde{M_{pp}} \quad (10)$$

4.2 Product space

What a country currently produces and exports with comparative advantage will have an impact on what they can feasibly produce in the future. Hausmann and Klinger (2007) claim that impact of productive structure on development is due to the relatedness between products, which dictated changes in the revealed comparative advantages of nations. The claim is supported by Hidalgo et al. (2007) stating that countries tend to move closer to products which they currently specialise – suggesting that a country's diversification is dependent on their current specialisation. Hence, capabilities of a country producing new products is dependent on their similarities in the capability requirements of products which are already produced. Based on this notion, Hausmann and Klinger (2007), and Hidalgo et al. (2007) develop a concept called product space - a network that connects products, and distance between each pair of products measures differences in capability requirement to produce for new products.

Figure 7: Illustration of World's Product Space in 2015



Source: The Observatory of Economic Complexity

Figure 7 illustrates the notion of product space in the world export market in 2015. Each node represents the export value of each product, and the size is determined by their share in world trade. Each node is color-coded by their respective product group. Links between each node represents the probability of two products being co-exported by countries. In the product space illustration, one can identify that products are either located at the outer edges of the space or densely populated at the core of the space. Products at the outer edges of the space are called peripheral products, and they are weakly connected, while products at the core are densely connected. The structural implication of the product space is that if a country is specialised in products at the core, it will be easier for that country to transform its economy into a productive one since the set of capabilities required to produce new products can be easily re-utilised for nearby products, while it would be difficult for countries specialising in peripheral products. An illustration of Myanmar's product space is described in the next section.

Findings by Hausmann and Klinger (2007), and by Hidalgo et al. (2007) suggest that countries move in the product space by developing new products which are related to, or have similarities in capabilities of the current export products. Hence, it is important to understand where a country stands in the product space, and how it can improve by moving into other products in the product space. Measures of this concept are presented in Hausmann and Hidalgo et al. (2011, p. 54). In general, new products that are feasible for a country can be identified through estimating capability distance between a specific product and the current product. Capability distance or simply distance is calculated by the proportion of capabilities necessary for a product that the country does not have.

The capability that the country *c* currently has can be measured by the proximity between products it is currently making and the product of interest *p.* Likewise, the capability it does not have can be measured by the proximity between products it is not currently making and the product of interest *p*. Proximity is quantified by Hausmann and Klinger (2007) based on the notion of revealed comparative advantage (RCA) of Balassa (1965) – which indicates whether a country make products effectively. RCA is written as:

$$RCA_{cp} = \frac{X_{cp}/\sum_{cp} X_{cp}}{\sum_c X_{cp}/\sum_c \sum_p X_{cp}} \qquad (11)$$

where X_{cp} is the value of exports by product *p* of country *c.* The value 1 is set as a threshold to determine whether products are produced effectively. $RCA_{cp}>1$ indicates that the country *c* is an effective exporter of product *p*, while $RCA_{cp}<1$ indicates that it is not. With RCA, Hausmann and Kligner (2007) define proximity[19] between product *p* and product *p' as:*

$$\varphi_{pp'} = min\{P(RCA_p > 1 | RCA_{p'} > 1), P(RCA_{p'} > 1 | RCA_p < 1)\} \qquad (12)$$

where $P(RCA_p>1 \mid RCA_{p'}>1)$ is defined as the probability that a country exports good *p* with *RCA>1,* given it also exports product *p'* with *RCA>1*. As our interest is to measure the probability of moving from a current set of products to a new set of products, distance is calculated by summing proximities between the product *p* and all the products in product space that a country is not exporting. The distance measure is normalised by dividing it by the sum of proximities between the product of interest *p* and all the products. If a country *c* produces most of the products which are connected to product *p*, the distance will be short, close to 0, otherwise, the distance will be large and close to 1. Formally, distance can be defined as:

$$d_{cp} = \frac{\sum_p (1 - M_{cp'})\varphi_{pp'}}{\sum_{p'} \varphi_{pp'}} \qquad (13)$$

Hausmann and Hidalgo et al. (2011) caution that distance measures just how far a product is from a country's current export basket, and it should not ignore the complexity of a country, since a country with a complex production structure given its current level of income can grow faster. In addition, they add that the opportunity to move in the product space could be different as some countries may be located close to poorly connected or simple products, while others may be in vicinity of highly connected or complex products. It can be referred that not just what countries can produce matter but also what opportunities exist for them. Taking consideration of both current complexity and unexploited opportunity of country *c,* a notion called "opportunity value" is quantified to

19 See Hausmann and Klinger (2007) for detailed construction of proximity measure.

capture the position of the country *c* in the product space in relation to being in vicinity of more products or complex products. Formally, opportunity value can be defined as:

$$opportunity\ value_c = \sum_{p\prime}(1 - d_{cp\prime})\left(1 - M_{cp\prime}\right)PCI_{p\prime} \quad (14)$$

where *PCIp'* is Product Complexity Index of product , and the term 1-$M_{cp'}$ is included to ensure that only the products that the country *c* is not producing are counted. With opportunity value, a measure called opportunity gain is used to capture the gain that the country *c* would obtain by producing product *p*. Opportunity gain is calculated a change in opportunity value that would be a result of developing product *p*. That could be written mathematically as:

$$opportunity\ gain_{cp} = \sum_{p\prime}\frac{\varphi_{pp\prime}}{\sum_{p"}\varphi_{p"p\prime}}\left(1 - M_{cp\prime}\right)PCI_{p\prime} - (1 - d_{cp})PCI_p \quad (15)$$

These quantified measures enable us to examine how complex Myanmar's output is, and identify the feasible products for Myanmar.

5 Myanmar product space, complexity and competitiveness

First, this section analyses and compares Myanmar product space with its peers - CLMV (Cambodia, Lao PDR, Myanmar, Vietnam) countries plus Thailand - to examine how different Myanmar product space is from its peers and to see how the country can move in product space by learning how its peers have moved (especially in the case of Thailand). Then, the section analyses Myanmar's recent developments in export, revealed comparative advantage and complexity.

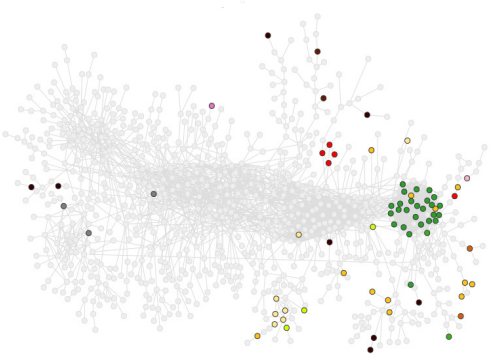
5.1 Analysing Myanmar product space by comparing with its peers

In Myanmar product space, only garment products (color-coded in green) are densely populated in the core area; peripheral products such as food including animal products and vegetable products (color-coded in yellow), and mineral products (color-coded in dark grey) are at the outer edges of the space. No other complex products such as machinery or electrical or transport equipment are observed in Myanmar product space. One can observe a few complex products like chemicals (color-coded in pink) in the produce space, however, they are at the outer edges of the space, and not connected with other products even within its product group (see panel A of Figure 8).

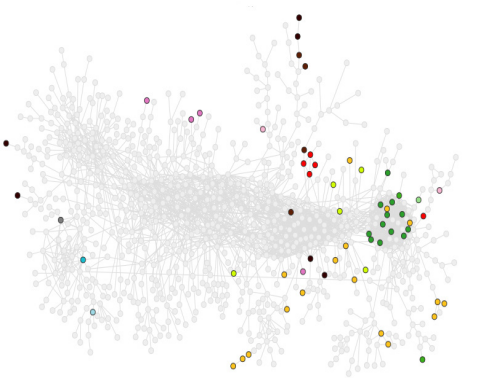
The product space illustration suggests that to produce more complex products, Myanmar needs to make a huge jump in the product space. Also, it could be implied that the textile/garment industry could a starting point for Myanmar to diversity its manufactured products since similar capabilities used in textile industry could be deployed in producing other manufactured products.

Figure 8: Product Space comparison between Myanmar and its peers

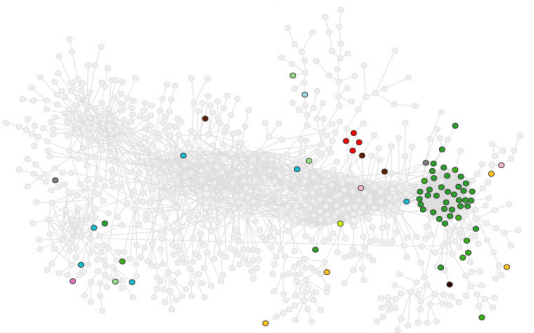
Panel A: Myanmar



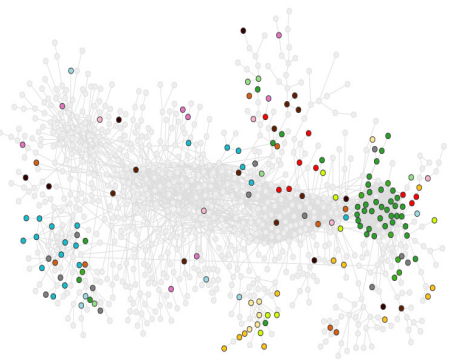
Panel B: Lao PDR



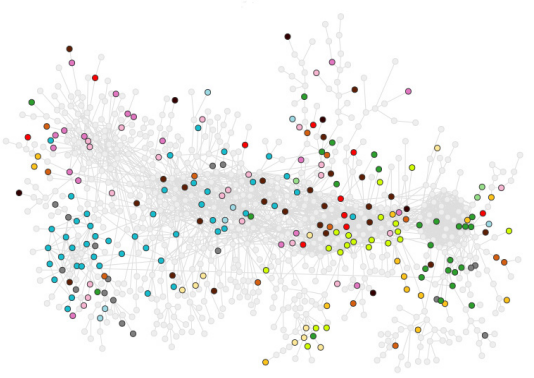
Panel C: Cambodia



Panel D: Vietnam



Panel E: Thailand



Source: The Atlas of Economic Complexity

Myanmar product space is similar to that of Laos and Cambodia. As shown in panels B and C of Figure 8, the product spaces of Cambodia and Laos have textile or garment products densely populated in the core area. In fact, Cambodia has a denser area of garment products in the product space than Myanmar and Lao's – implying perhaps that Cambodia's textile/garment industry is more developed than Myanmar's. A noticeable difference between Cambodia's product space and the product spaces of Myanmar and Lao is that Cambodia has less food products than Myanmar and Laos, but it seems that it is able to produce machinery/transport products (color-coded in light blue), even though such products are not densely populated in the core of product space.

Analysing the product spaces of Cambodia, Laos and Myanmar show a typical product space of a developing country whose manufacturing sector is at a nascent stage. Vietnam's product space shows that its productive structure is more complex and diverse than its peers from the CLMV group. Like other developing countries in lower-middle income groups, the textile/garment sector is densely populated in the core of the product space, but as shown in panel D, machinery/transport products are more connected for Vietnam than other CLMV countries even though they are not densely populated in the core yet.

The product space of Thailand shows a different story than the CLMV countries. More complex products such as chemicals, machinery and transport products are more visible and connected. Even in less complex product group such as food, light yellow nodes (which represent foodstuffs) are in the core area and other food products such as animal and vegetable products are at the outer edges - indicating a more complex or productive economy exporting more value-added products rather than raw materials. Product space analysis can imply that the textile/garment industry could a starting point for developing countries in lower-middle group; from the textile industry, these countries can jump to more complex products in the manufacturing sector as shown in Thailand's product space. The next sub-section analyses details on Myanmar's productive structure; then, a possible route for Myanmar to improve its productive structure through the manufacturing sector can be observed.

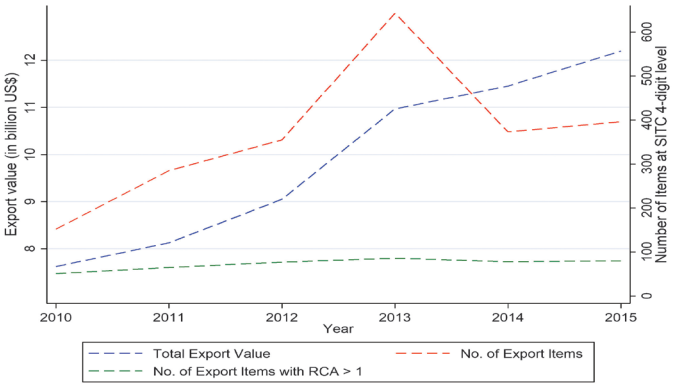
5.2 Analysing Myanmar comparative advantage and complexity

Myanmar's exports both in terms of value and the number of export items with revealed comparative advantage (RCA)[20] increased in 2015 compared to 2010, while the number of exports reached its peak in 2013. These statistics tell us that Myanmar has achieved export growth overtime in general. Having a large number

20 Items with RCA >1 are considered to have revealed comparative advantage.

of export items is a must for the country to transform its economy from being reliant on a few sectors to a more diverse economy. In general, Myanmar has expanded the number of products in which it has a comparative advantage between 2015 and 2000. Looking at export value and the number of export items, it could be concluded that Myanmar exports have been transformed (see Figure 9). However, an increase in export value and items does not tell us whether Myanmar is exporting complex products[21]. Moreover, it would be biased to conclude that Myanmar's exports are expanding without looking at other related indicators such as Myanmar's comparative advantage and complexity.

Figure 9: Myanmar's Export Trends (2010 – 2015)

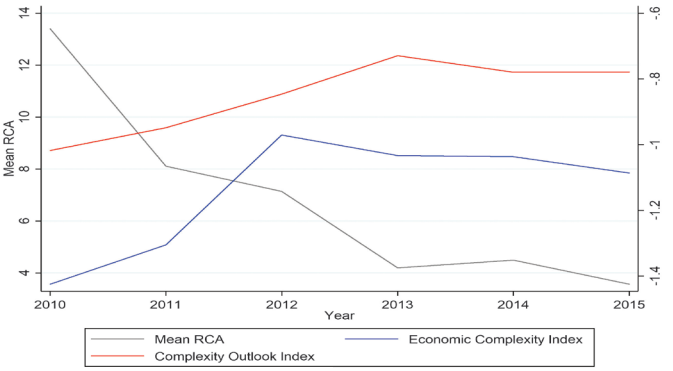


Source: Data from WITS-UNComtrade

As shown in Figure 10, Myanmar's complexity and RCA trends appear to have decreased in recent years – indicating that Myanmar's exports have become less complex and effective in the global market, as witnessed above in that Myanmar's export basket is concentrated in primary commodities. In addition, as it has become a less productively complex country, its effectiveness in global market is also decreasing since there are many other countries producing what Myanmar can produce. Moreover, Myanmar's complexity is lower for its income than both the global averages and other lower middle-income countries (see Figure 11). Hence, upward trends in export value and items could be good news but it is important to be mindful that Myanmar's position in the global market is decreasing due to its concentration in so few sectors.

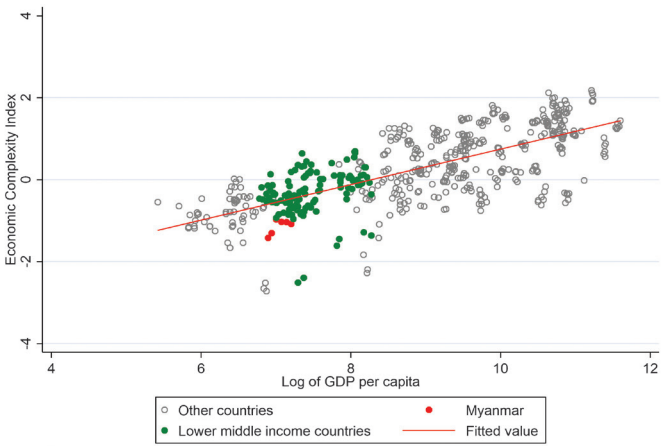
21 Hausmann and Hidalgo et. al (2011) mention that being able to complex products requires specific knowledge and capabilities. Hence, a product is said to be complex if it is produced by a few countries. Likewise, a country (or an economy) is considered as complex if it can produce complex products.

Figure 10: Myanmar's Complexity and RCA (2010 – 2015)



Source: Data from WITS-UNComtrade

Figure 11: Myanmar's economic complexity is below average for its income (2010 – 2015)

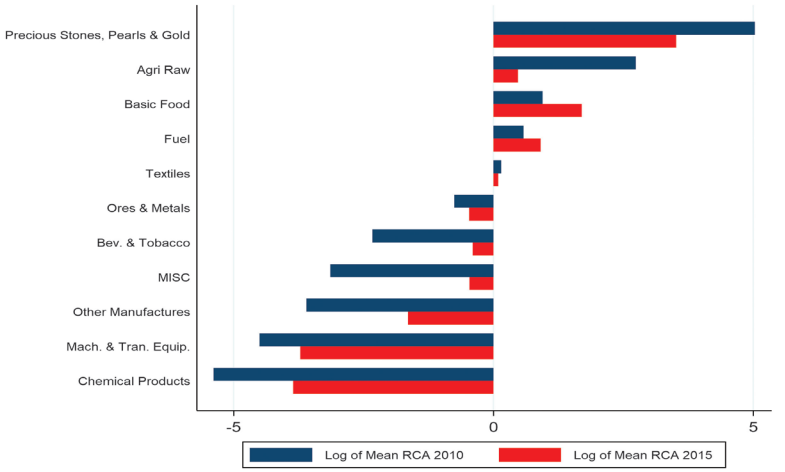


Source: Data from WITS-UNComtrade and WDI

The decrease in mean RCA of Myanmar could explained by a sharp drop of precious stones, pearls and gold exports, and agricultural raw products between 2010 and 2015. Figure 12 compares mean the RCA of product groups between 2010 and 2015 by taking log values of RCA to give us a better presentation of comparison as log of 1 is equal to 0 (which means product groups with log RCA greater than 0 represent effectiveness of Myanmar as an exporter). In general, Myanmar is an effective exporter in the following product groups: precious stones, pearls & gold, agricultural raw products, basic food products, fuel products

and textile products, in both 2010 and 2015. The drop in RCA of precious stones, pearls & gold, and agricultural raw products between them contribute to overall drop in RCA of Myanmar. These findings are mainly consistent with the findings of Kim and Thunt (2017) that Myanmar's RCA lies in natural resources, the agricultural industry and textile industry, and the drop of the RCA is observed in precious stones, pearls and gold, and agricultural sectors.

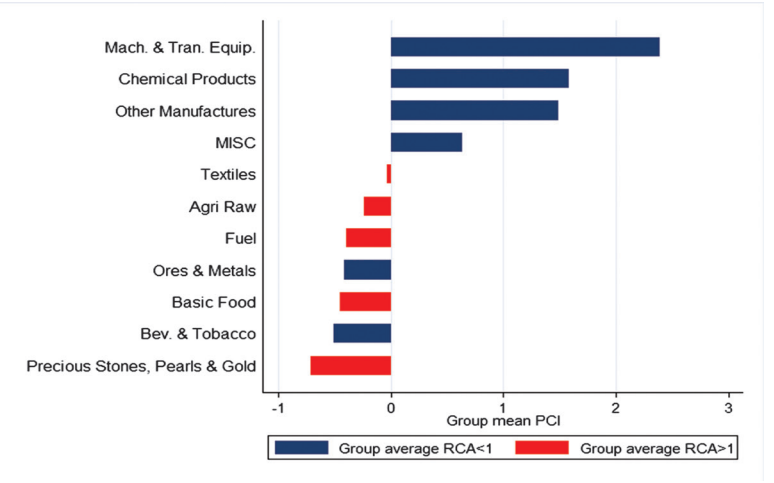
Figure 12: Comparison of Mean RCA (2010 – 2015)



Source: Data from WITS UNComtrade

However, a slight contradiction between the two studies exists in textile and fuel sectors as Kim and Thunt (2017) find that the RCA of natural gas has decreased overtime while RCA of the textile sector has increased. Changes in textile and fuel sectors of this study are not much significant compared to other sectors. One of the possible solutions for slight contradiction between two studies could be due to use of different classifications – Harmonized System (HS) in Kim and Thunt (2017) and SITC in this study, or different grouping method for products. However, in general both studies find the decrease in Myanmar effectiveness as an exporter between 2010 and 2015. The good news is that Myanmar seems to have increased its RCA value for product groups that currently do not have RCA (see Figure 12); it could be cautiously implied that such products have been effectively exported recently.

Figure 13: Complexity of Myanmar Products in 2015, comparison between product group with RCA > 1 and RCA <1



Source: Data from WITS UNComtrade

Characteristics of Myanmar product groups in 2015 is detailed in Table 1- which ranks product groups by their mean RCA value, and it is observed that Myanmar exports only low complex products as indicated by the product complexity index (PCI); also, products with RCA are less complex than those without RCA (see Figure 12). Figure 13 shows average complexity of product groups – split into 2 groups – producing group and not producing group. Producing[22] is defined here for products with RCA > 1 while not producing for products with RCA <1.

Table 1: Characteristics of Myanmar product groups in 2015

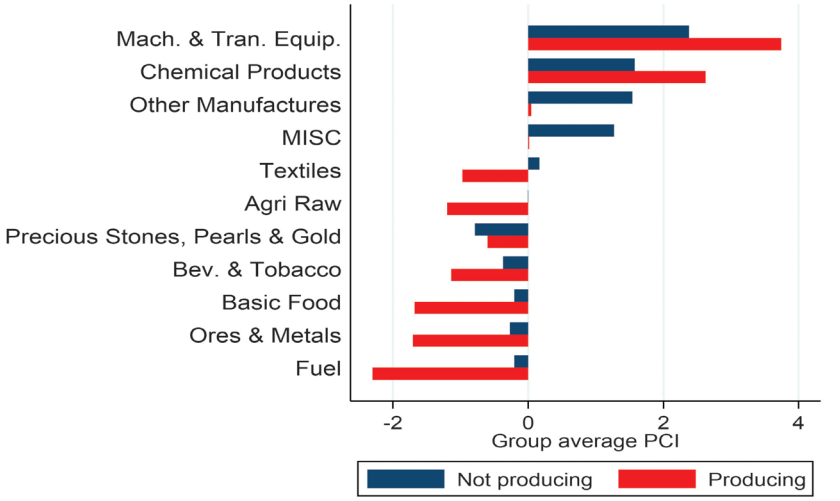
Product Group	Distance	Share in Export Basket (%)	Mean RCA	Mean PCI	Share of Producing Product (%)	Share in Global Market
Precious Stones, Pearls & Gold	0.94	5.58	33.68	-0.71	40.00	0.19
Basic Food	0.96	29.71	5.45	-0.45	16.56	0.31
Fuel	0.95	40.99	2.48	-0.39	9.09	0.29

22 The rationale behind classifying producing and not producing by RCA is that products with RCA > 1 are considered as products that a country is producing and exporting effectively, hence, they can compete in global market, and products with RCA <1 are considered as products that a country is not producing and exporting effectively, hence, no capability to compete in global market. Such practice is outlined in complexity literature, and the goal is to produce more competitive products that can increase complexity of a country.

Agri Raw	0.96	2.23	1.60	-0.24	19.51	0.15
Textiles	0.95	8.85	1.10	-0.03	17.65	0.14
Bev. & Tobacco	0.93	0.18	0.67	-0.51	18.18	0.02
MISC	0.95	5.03	0.63	0.64	50.00	0.10
Ores & Metals	0.95	2.11	0.63	-0.41	9.68	0.05
Other Manufactures	0.97	4.90	0.19	1.49	3.63	0.02
Mach. & Tran. Equip.	0.97	0.33	0.02	2.39	0.46	0.00
Chemical Products	0.97	0.09	0.02	1.58	0.76	0.00

As shown in Figure 14, what Myanmar is producing are less complex than the products that Myanmar is not producing. It is also interesting to see that the manufactures and chemical products that Myanmar is producing are more complex than the 'not producing' products, but their share in the export basket is not significant. Table 2 presents characteristics of Myanmar top 10 products ranked by RCA value in 2015. Cargo rice/brown rice (SITC 0422) is the top export of Myanmar with a stunning RCA of 424.57, and it is the market leader, dominating with about 34 per cent of the global market even though its shares in Myanmar export basket is only about 4 per cent. One of the explanations for the high RCA of cargo/brown rice is due to the lower number of countries producing brown rice effecitvely. In fact, there were only 22 countries producing this product in 2015.

Figure 14: Complexity of Myanmar Products in 2015, comparison between producing products and non-producing products



Source: Data from WITS UNComtrade

Table 2: Top Ten Myanmar Exports in 2015, Ranked by RCA

Product	Description	Export Value (in 1,000 USD)	RCA	PCI	Share of Product in Global Market (%)	Share of Product in Export Basket (%)
0422	Rice, husked (cargo rice/ brown rice)	461,410	424.57	-1.38	33.63	3.78
0542	Leguminous vegetables, dried, shelled	1,306,388	148.74	-2.44	11.78	10.71
6673	Ungraded precious stones (other than diamonds) and semiprecious stones	667,670	145.37	-1.19	11.51	5.47
2225	Sesame seeds	195,514	84.99	-3.99	6.73	1.60
3431	Natural gas, liquefied	4,783,203	53.12	-2.40	4.21	39.22
2221	Groundnuts, not roasted or otherwise cooked	63,357	35.04	-1.82	2.78	0.52
0352	Fish, salted but not dried or smoked and fish in brine	23,677	31.00	-2.11	2.46	0.19
0612	Other beet or cane sugar and chemically pure sucrose, in solid form	263,799	29.48	-0.61	2.33	2.16
8413	Men's/boy's jackets/blazers, not knitted/crocheted	162,143	25.32	-0.73	2.01	1.33
6671	Pearls (natural or cultured), whether or not worked or graded but not strung, mounted or set; ungraded pearls (natural or cultured), temporarily strung for convenience of transport	12,361	22.97	-0.02	1.82	0.10

Among the top 10 products, natural gas and leguminous vegetable have a quite significant share of Myanmar export basket. The top ten basket is dominated mainly by basic food products. Only one textile product from the manufacturing sector is included in the basket. In addion, Myanmar is exporting precious items as raw materials – which can potentially bring higher export earnings if exported as value-added (in the form of jewelry for instance). Being dominated by primary commodities does not imply that Myanmar is not producing any complex items.

Table 3: Top 10 Most Complex Products of Myanmar in 2015, Ranked by PCI

Product	Description	Export Value (in 1,000 USD)	RCA	PCI	Share of Product in Global Market (%)	Share of Product in Export Basket (%)
7312	Machining centres, unit construction machines (single station) and multi-station transfer machines for working metal.	4	0.00	4.73	0.00	0.00
7282	Parts and accessories of machines and apparatus	33	0.00	4.55	0.00	0.00
8713	Parts and accessories thereof, n.e.s. of diffraction apparatus	8	0.01	4.30	0.00	0.00
7484	Gear boxes & other speed changers, including torque converters	1	0.00	3.75	0.00	0.00
7133	Internal combustion piston engines, marine propulsion	17,446	3.42	3.74	0.27	0.14
7599	Parts and accessories suitable for use solely or principally with the machines of subgroups 7511, 7512, 7519 and group 752	81	0.00	3.70	0.00	0.00
8841	Lenses (including contact lenses), prisms, mirrors and other optical elements, of any material, unmounted, other	10,720	0.53	3.60	0.04	0.09
6942	Screws, bolts, nuts, coach screws and similar articles, of iron or steel	1	0.00	3.50	0.00	0.00
7441	Parts, n.e.s., of the foregoing vehicles	4	0.00	3.50	0.00	0.00
7431	Air or vacuum pumps, air or other gas compressors, ventilating or recycling hoods (other than cooker hoods) incorporating a fan	4	0.00	3.49	0.00	0.00

Table 3 lists the top 10 most complex products of Myanmar in 2015, ranked by PCI. All complex items that Myanmar is currently producing do not have any comparative advantage, and their shares in both global market and its own export basket are also not significant, except product code SITC 7133, internal combustion

piston engines, marine propulsion items, with having an RCA of 3.42. Table 3 tells us that the most complex items that Myanmar is producing are from the manufacturing sector, and Myanmar needs more capabilities in producing those items to diversify its product base. However, it indicates that Myanmar still has complex products in its baskets even though it does not have RCA in such products – which implies that Myanmar is not effective in producing/exporting manufactured goods. Being able to produce more complex exports requires certain producing capabilities, besides, there could be many more constraints for producing such products, for instance, meeting standards of importing countries. Hence, more analytical work in identifying constraints of Myanmar manufacturing sector is needed.

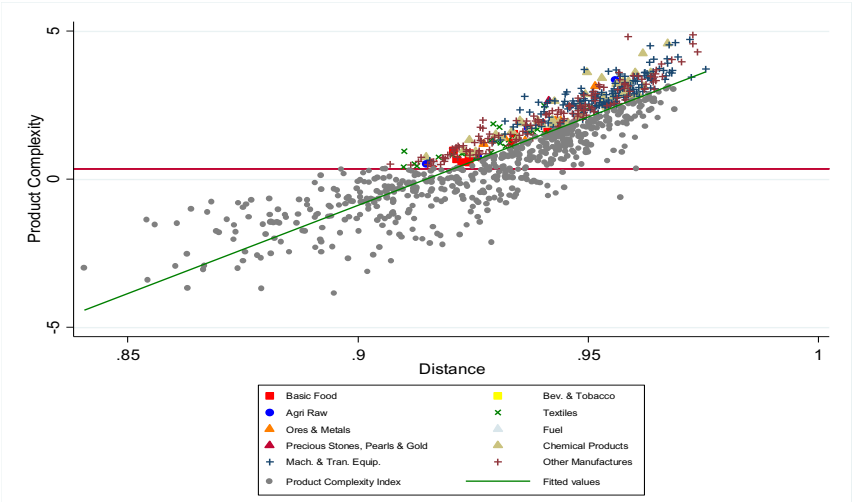
6 DIVERSIFYING MYANMAR EXPORT BASE

Using a method employed by Hausmann et al, (2014, and elsewhere), new potential products are identified by analysing products or sectors that can offer higher returns in terms of complexity and opportunity value relative to its distance in product space through the notion of efficiency frontier. Generally, this method plots complexity or opportunity gain of products against their relative distance. However, trade-offs are inevitable as products with higher complexity and opportunity gain are far from the current complex space as more capabilities are required to produce such product.

A total of 942 products that Myanmar is not producing with comparative advantage[23] are plotted in product space – which is done by running bivariate regressions on complexity and opportunity gain of products against their relative distance, then, products with positive residuals are identified as potential products. Considering trade-offs mentioned above in diversifying new products, horizontal cut-off lines are defined to ensure higher returns on complexity and opportunity gain. In Figure 15, Myanmar's average product complexity, .36, is used to define the horizontal line, and in Figure 19, opportunity gain of value zero is used as a horizontal cut-off line. By doing this, Myanmar can increase its complexity and the opportunity gain of its export basket. Finally, products which are above both horizontal and diagonal lines are identified as potential products.

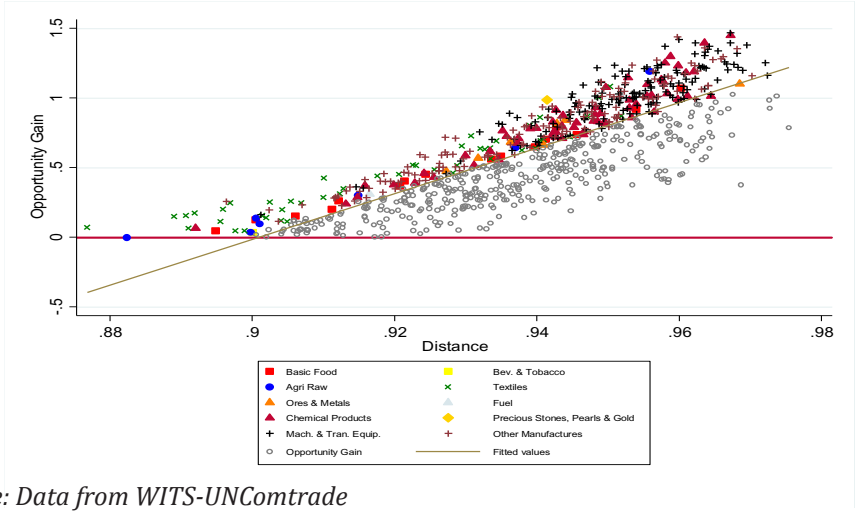
23 The reason why products with RCA <1 is considered as not producing products is that Myanmar is not producing such products effectively in the global markets; the purpose of identifying new products to make the products which Myanmar can produce effectively and compete in global market effectively.

Figure 15: Myanmar's efficiency frontier based on complexity and distance, 2015



Source: Data from WITS-UNComtrade

Figure 16: Myanmar's efficiency frontier based on opportunity gain and distance, 2015

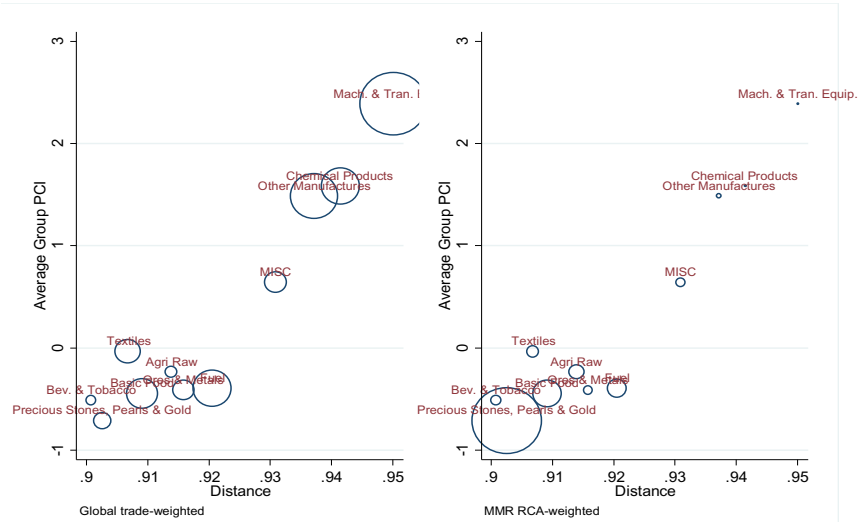


Source: Data from WITS-UNComtrade

Figures 15 and 16 depict that chemical products, machinery and transport equipment products can increase both complexity and opportunity gain for the Myanmar product space. Yet, both product sectors require Myanmar to jump further away from its current capabilities – implying that it would take a longer

period for Myanmar to develop required capabilities in producing such products. Indeed, these products have large global market and higher product complexity and opportunity gain – implying that being able produce such products requires complex capabilities, and their returns are also relatively higher; but Myanmar lacks comparative advantage in such products (see Figure 17 and Figure 18). On the other hand, textile products, basic food products and products in "other manufactures" category[24] can increase both complexity and opportunity value to some extent. Among these products, Myanmar has higher comparative advantage in basic food sector than the other two. Still, Myanmar's comparative advantage in the 'other' manufactures product group is quite low, despite having large global market share and high return in complexity and opportunity gain (as in Figure 17 and Figure 18).

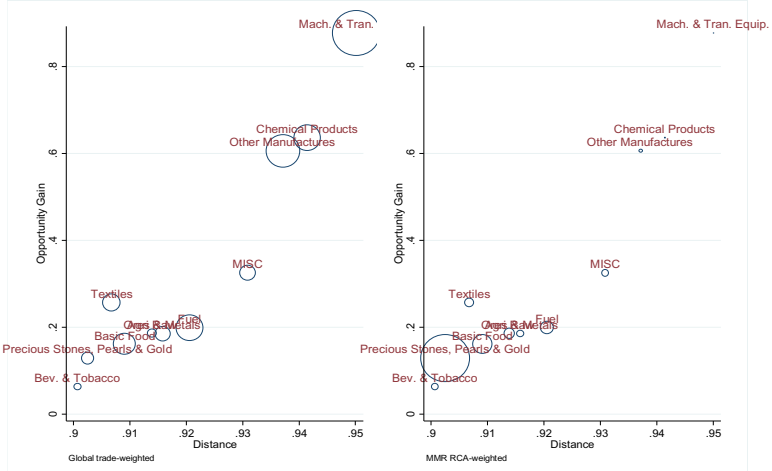
Figure 17: Complexity and distance in 2015, with global trade weight and Myanmar RCA weight



Source: Data from WITS-UNComtrade

24 "Other manufactures" includes products in section 6 (manufactured goods) and section 8 (miscellaneous manufactured articles) with exclusion of SITC 667 (pearls, precious and semi-precious stones), SITC 68 (non-ferrous metals), SITC 65 (textile yarn and related products), and SITC 84 (articles of apparels and clothing accessories). In general, products in "other manufactures" category are products that are less complex than manufactures such as machinery and transport equipment, and chemical products but more complex than textiles.

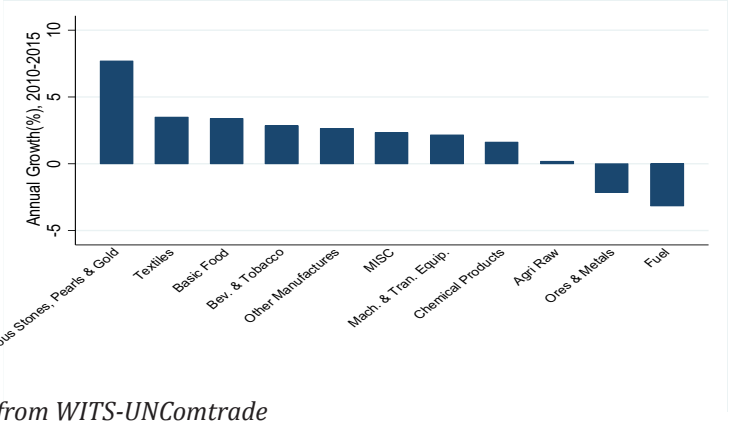
Figure 18: Opportunity Gain and distance in 2015, with global trade weight and Myanmar RCA weight



Source: Data from WITS-UNComtrade

Table 4 quantifies Figures 15 and 16; total of 428 products are identified as feasible for Myanmar. Since Myanmar's current capability is far away from complex products, it is not very possible to produce all feasible products. As shown in Figure 19, growth of mineral products such as fuel, and ores and metals decreased between 2010 and 2015 while other sectors expanded. Hence, mix of products from basic food, textile and other manufacture sectors are the most feasible for Myanmar, and can help relax the heavy reliance on fuel sector. In addition, it could be a warning for Myanmar that reliance on natural resources such as natural gas, ore and metals could expose unstable export earnings.

Figure 19: Annualised Global Trade Growth Between 2010 and 2015



Source: Data from WITS-UNComtrade

Table 4: The new products for Myanmar and their characteristics

Product Group	Potential Products	Avg. Residual	Avg. Opportunity Gain	Avg. PCI	Avg. Distance
Precious Stones,	1	1.07	0.99	2.66	0.94
Mach. & Tran. Equip.	159	0.56	1.00	2.84	0.95
Chemical Product	54	0.50	0.85	2.44	0.95
Other Manufactures	148	0.50	0.76	2.09	0.94
Agri. Raw Products	4	0.49	0.64	1.60	0.93
Textiles	34	0.42	0.60	1.36	0.93
Ores & Metals	6	0.40	0.70	1.84	0.94
Fuel	2	0.35	0.65	1.52	0.93
Basic Food	20	0.25	0.48	1.13	0.93

Among the 428 feasible products, feasibility is identified by imposing strict conditions on products with residuals above average (above the fitted lines in Figure 15), with distance below average, with opportunity gains greater than zero and with complexity above average of the existing products. To diversify Myanmar's product base with products having higher return on complexity and opportunity gain, and not very far away from Myanmar - 75 products are identified as the most promising products, and the new product basket is mainly dominated by the manufactured product group (but which are less complex than other form of manufactures such as machinery and transport equipment, and chemical products). Table 5 presents the top 10 promising products for Myanmar – jointly dominated by textiles and other manufacture products.

Table 5: Top 10 promising products

Product	Description	Group	Distance	Residual
6794	Other tubes, pipes and hollow profiles (e.g., open seam or welded, riveted or similarly closed), of iron or steel	Other Manufactures	0.91	0.98
8462	Panty hose, tights, stockings, socks and other hosiery, including graduated compression hosiery (for example, stockings for varicose veins) and footwear without applied soles, knitted or crocheted	Textiles	0.91	0.70
2672	Waste (including noils, yarn waste and garnetted stock) of man-made fibres	Textiles	0.91	1.23
8931	Articles for the conveyance or packing of goods, of plastics; stoppers, lids, caps and other closures, of plastics	Other Manufactures	0.91	0.69
8481	Articles of apparel and clothing accessories, of leather or of composition leather (not including gloves, mittens and mitts of heading 894.77)	Textiles	0.91	0.68
6562	Labels, badges and similar articles of textile materials, in the piece, in strips or cut to shape or size, not embroidered.	Textiles	0.91	0.57
6359	Manufactured articles of wood, n.e.s.	Other Manufactures	0.91	0.70
8993	Candles; matches, pyrophoric alloys, articles of combustible materials; smokers' requisites	Other Manufactures	0.91	0.80
5421	Medicaments containing antibiotics or derivatives thereof	Chemical Products	0.91	0.75
2511	Recovered (waste and scrap) paper or paperboard.	Agri Raw	0.91	0.52

As mentioned previously, diversification has spillover effects on an economy as producing new products that require more labour, more capital, and more technology. Linking new feasible products identified in Figures 15 and 16 with relevant industrial policies is made possible by Hausmann et al. (2014) as discovering new products will create more employment opportunities. However, policy makers may face a trade-off between more jobs and better jobs. The rationale behind the trade-off is that producing less sophisticated products requires less sophisticated knowledge and skills, and vice versa for more sophisticated products. Hence, focusing on new products that are closer to the

existing product space will lead to the creation of jobs for the majority of workers making products that are not sophisticated, and likewise, focusing on far way products with higher return on complexity and opportunity gain will lead to the creation of high-skilled jobs (or better jobs).

To balance this trade-off – creating more jobs or better jobs, Hausmann et al. (2014) quantitatively develop two strategies for producing potential products – namely a 'parsimonious' transformation strategy and strategy bets. The former emphasises products that are close to capabilities in the existing product space but with high strategic return, and the latter emphasises products that are more complex and have higher strategic returns. Hence, a parsimonious transformation strategy can help a country create more jobs for workers as new product sophistication is not far away their current skills. On the other hand, strategy bets can help a country create better jobs (or more skilled jobs) for high-skilled workers. These two strategies are quantified by standardizing complexity, opportunity gain and distance with mean 0 and standard deviation 1.

Table 6: The most feasible products for Myanmar and their characteristics

Product Group	Potential Products	Avg. Opportunity Gain	Avg. PCI	Avg. Distance
Other Manufactures	69	0.41	0.80	0.92
Textiles	29	0.42	0.74	0.92
Basic Food	25	0.27	0.46	0.92
Chemical Product	22	0.38	0.71	0.92
Mach. & Tran. Eq	12	0.43	0.81	0.93
Ores & Metals	10	0.37	0.57	0.93
Agri Raw	5	0.32	0.61	0.93
Fuel	3	0.26	0.22	0.92
Bev. & Tobacco	2	0.27	0.40	0.92

A parsimonious strategy emphasises on nearby products with less sophistication, hence, more weight is applied to distance. Strategy bets emphasise products with higher sophistication, hence, more weight is applied to complexity and opportunity gain[25]. In addition, certain conditions on complexity, opportunity gain and distance are imposed to identify the most viable products; hence, products with opportunity gains of zero or less, with greater than average distance and with complexity index in the bottom 25th percentile are excluded.

25 Parsimonious transformation strategy takes 60 per cent of weight on distance, and 20 per cent of weight each on complexity and opportunity gain. Strategy bets takes 20 per cent of weight on distance, and 40 per cent of weight each on complexity and opportunity gain.

With these imposed conditions, Myanmar has a total of 177 potential products. Table 6 presents the characteristics of those products as groups. One thing to note is that conditions imposed on Table 4 and Table 6 are slightly different; in Table 6, no condition is imposed on residuals, unlike in Table 4. Hence, a few products under the diagonal line of Figure 15 could be included in Table 6 – indicating that such products could be quick wins when a parsimonious transformation policy is applied. Indices for both a parsimonious transformation strategy and strategy bets are constructed, and ranks are assigned to all 177 potential products.

Table 7: Top 20 Products for parsimonious transformation

Product	Description	Product group	Distance
6575	Twine, cordage, ropes and cables and manufactures thereof (e.g., fishing nets, ropemakers Æ wares)	Textiles	0.89
8519	Parts of footwear (including uppers, whether/not attached to soles other than outer soles); removable insoles, heel cushions & similar articles; gaiters, leggings & similar articles & parts thereof	Other Manufactures	0.90
8461	Clothing accessories (other than those for babies), not knitted or crocheted	Textiles	0.90
6518	Yarn (other than sewing thread) of staple fibres; synthetic monofilament, n.e.s.; strip and the like of synthetic textile materials of an apparent width not exceeding 5 mm	Textiles	0.90
2672	Waste (including noils, yarn waste and garnetted stock) of man-made fibres	Textiles	0.91
7731	Insulated (including enamelled or anodized) wire, cable (including co-axial cable) and other insulated electric conductors, whether or not fitted with connectors; optical fibre cables made up of individually sheathed fibres, whether or not assembled with	Mach.& Tran. Equip.	0.90
6552	Other knitted or crocheted fabrics, not impregnated, coated, covered or laminated	Textiles	0.91
6794	Other tubes, pipes and hollow profiles (e.g., open seam or welded, riveted or similarly closed), of iron or steel	Other Manufactures	0.91
8482	Articles of apparel and clothing accessories (including gloves), for all purposes, of plastics or of vulcanized rubber (other than hard rubber)	Textiles	0.90
6996	Articles of iron or steel, n.e.s.	Other Manufactures	0.93
0583	Fruit and nuts, uncooked or cooked by steaming or boiling in water, frozen, whether or not containing added sugar or other sweetening matter	Basic Food	0.91
8456	Swimwear	Textiles	0.91

6423	Registers, account-books, notebooks, order books, receipt books, letter pads, memorandum pads, diaries and similar articles, exercise books, blotting pads, binders (loose-leaf or other), folders, file covers, manifold business forms, interleaved carbon	Other Manufactures	0.90
8462	Panty hose, tights, stockings, socks and other hosiery, including graduated compression hosiery (for example, stockings for varicose veins) and footwear without applied soles, knitted or crocheted	Textiles	0.91
8993	Candles; matches, pyrophoric alloys, articles of combustible materials; smokersÆ requisites	Other Manufactures	0.91
8481	Articles of apparel and clothing accessories, of leather or of composition leather (not including gloves, mittens and mitts of heading 894.77)	Textiles	0.91
6359	Manufactured articles of wood, n.e.s.	Other Manufactures	0.91
6562	Labels, badges and similar articles of textile materials, in the piece, in strips or cut to shape or size, not embroidered.	Textiles	0.91
8931	Articles for the conveyance or packing of goods, of plastics; stoppers, lids, caps and other closures, of plastics	Other Manufactures	0.91
0622	Sugar confectionery (including white chocolate), not containing cocoa	Basic Food	0.91

Table 7 presents the top 20 products identified by a parsimonious strategy, with products from the textile group and other manufactures group dominating the basket with one item from machinery and transport equipment group and two from basic food group. Table 8 lists the top 20 products identified by strategy bets – dominated mainly by other manufactures group, followed by textile products. In general, the top products identified by both strategies are mainly manufacture products – from textiles and other manufactured group. That is not surprising as both product groups are identified as potential ones with higher return on complexity and opportunity gain.

The slight difference between the products in each strategy is that products identified by strategy bets seems to require more complex processing capabilities. In fact, not just textile and other manufactures product groups, Myanmar has potential also in basic food products, and a certain number of products in the chemical and machinery/transport equipment product groups, given their characteristics in Table 6. Indeed, basic food products can be included in the list of parsimonious strategy products when diversifying Myanmar product base even there are only two of these products in top 20 products identified by parsimonious strategy. Likewise, certain chemical products and machinery/transport equipment products can be included in the list of strategy bets products.

A parsimonious strategy can be also used as a short-term policy tool to diversity an economy horizontally (i.e. adding new products within sectors to product baskets) since it can be devised immediately while strategy bets can be used as a long-term policy tool as it takes time to train workers to gain sophisticated skills and accumulate know-hows. Strategy bets can be also used in diversifying an economy vertically, as jumping from raw products to value-added products requires sophisticated capabilities in all aspects. Hence, focusing on products identified by a parsimonious transformation strategy can add complexity and opportunity gain to Myanmar product basket in the short term while products identified by strategy bets can be produced in the future when Myanmar's product complexity could jump to another level.

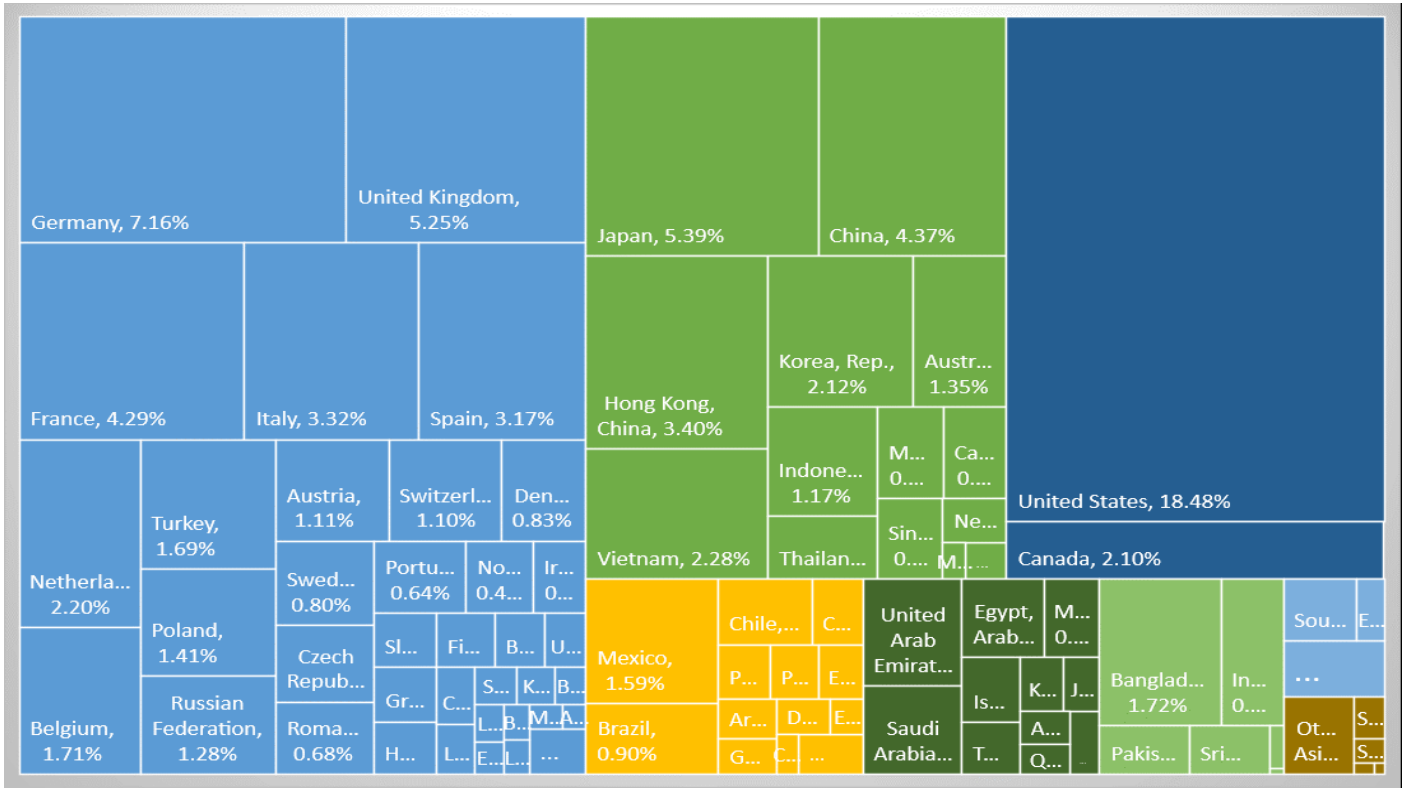
Table 8: Top 20 Products for strategy bets

Product	Description	Product Group	Distance
6996	Articles of iron or steel, n.e.s.	Other Manufactures	0.93
7851	Motor cycles (including mopeds) and cycles fitted with an auxiliary motor, with or without side-cars; side-cars	Mach. & Tran. Equip.	0.93
2665	Synthetic staple fibres, not carded, combed or otherwise processed for spinning.	Textiles	0.93
2671	Artificial fibres suitable for spinning	Textiles	0.93
6633	Manufactures of mineral materials, n.e.s. (other than ceramic)	Other Manufactures	0.93
6911	Structures (excluding prefabricated buildings of group 811) and parts of structures (e.g., bridges and bridge sections, lock-gates, towers, lattice masts, roofs, roofing frameworks, doors and windows and their frames and thresholds for doors, shutters and bridges	Other Manufactures	0.93
5535	Pre-shave, shaving or aftershave preparations, personal deodorants, bath preparations, depilatories and other perfumery, cosmetic or toilet preparations, n.e.s.; prepared room deodorizers, whether or not perfumed or having disinfectant properties	Chemical Products	0.93
6644	Float glass and surface ground or polished glass, in sheets, whether or not having an absorbent, reflecting or non-reflecting layer, but not otherwise worked	Other Manufactures	0.93
5822	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials	Chemical Products	0.93

6429	Articles of paper pulp, paper, paperboard or cellulose wadding, n.e.s.	Other Manufactures	0.93
6122	Saddlery & harness for any animal (including traces, leads, knee-pads, muzzles, saddle-cloths, saddle-bags, dog coats & the like), of any material	Other Manufactures	0.93
6579	Special products of textile materials	Textiles	0.93
8942	Tricycles, scooters, pedal car & similar wheeled toys; dolls' carriages; dolls; other toys; reduced-size (scale) models & similar recreational models, working/not; puzzles of all kinds	Other Manufactures	0.93
6734	Flat-rolled products of iron or non-alloy steel, not clad, plated or coated, not further worked than cold-rolled (cold-reduced)	Other Manufactures	0.93
6732	Flat-rolled products of iron or non-alloy steel, not clad, plated or coated, not further worked than hot-rolled	Other Manufactures	0.93
6842	Aluminium and aluminium alloys, worked	Ores & Metals	0.93
6532	Fabrics, woven, of synthetic staple fibres, containing 85% or more by weight of such fibres (other than pile and chenille fabrics)	Textiles	0.93
8215	Furniture, n.e.s., of wood	Other Manufactures	0.93
6563	Gimped yarn, and strip and the like of heading 651.77 or 651.88, gimped (other than metallized yarn and gimped horsehair yarn); chenille yarn (including flock chenille yarn); loop-wale yarn; braids in the piece; ornamental trimmings in the piece, without	Textiles	0.93
6254	Tyres, pneumatic, new, of a kind used on motorcycles and bicycles	Other Manufactures	0.92

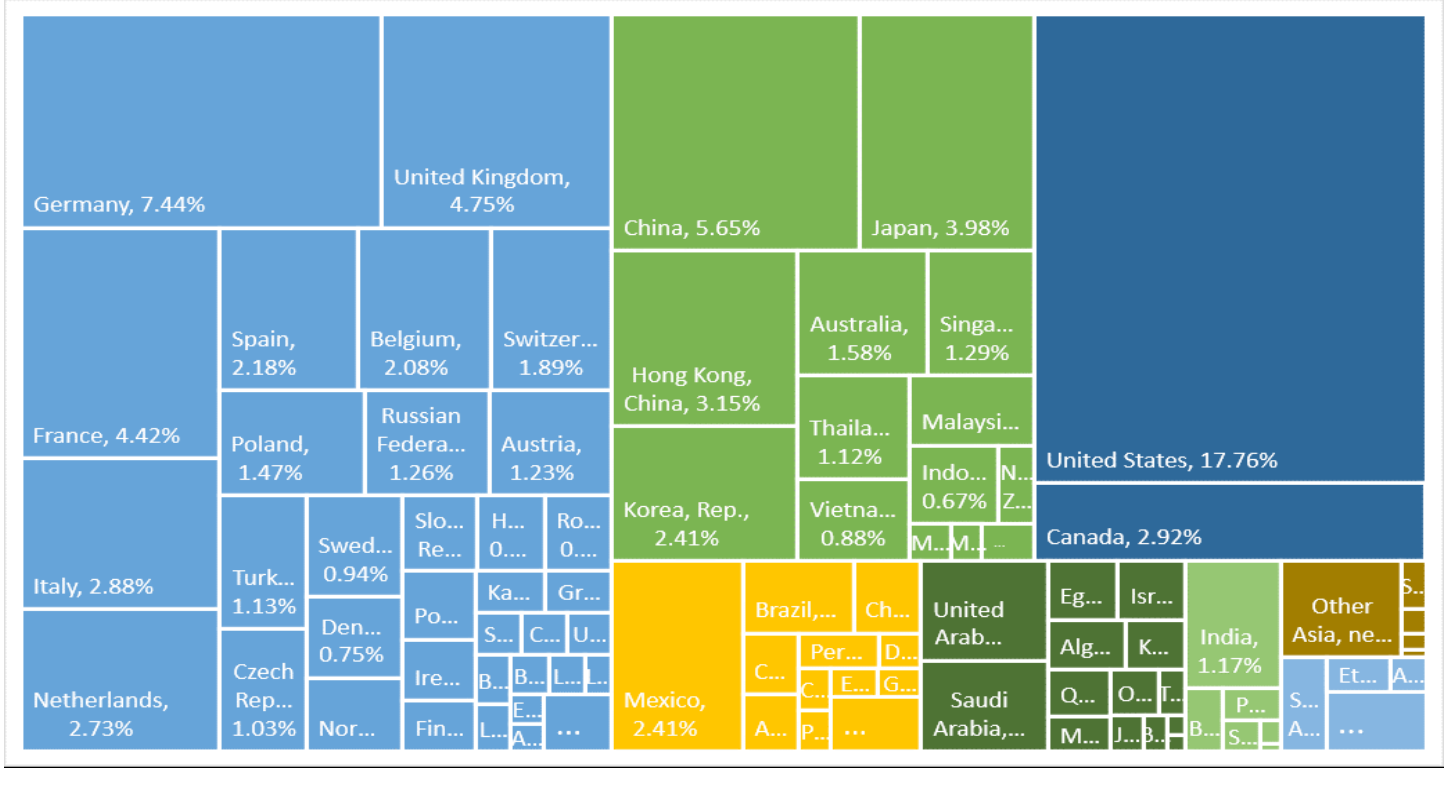
After identifying new feasible products, another task would be identifying markets to export those new products. That could be briefly analysed by identifying importers for new products. In this way, some other possible challenges such as access to new markets could be identified. Figure 20 shows the share of textile importers in 2015; Europe & Central Asia is the top importer of textile products with 41.5 per cent of total textile imports, followed by Asia & Pacific with 22.9 per cent, and North America 20.6 per cent. Identifying top five importers by country, the United States dominates the textile imports with 18.48 per cent, followed Germany with 7.16 per cent, Japan with 5.39 per cent, the United Kingdom with 5.25 per cent and China with 4.37 per cent.

Figure 20: Share of textile importers in 2015



Source: Data from UNComtrade-WITS

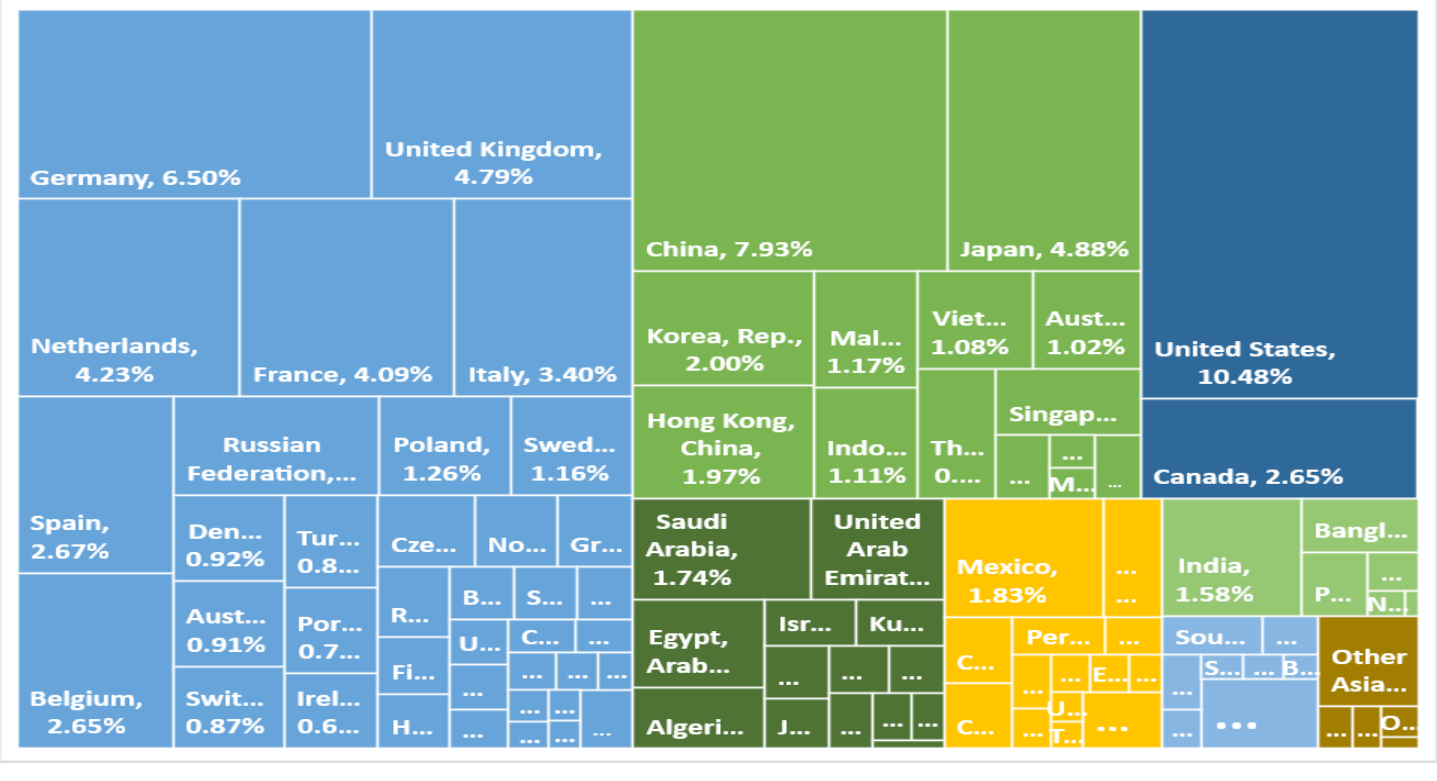
Figure 21: Share of other manufactures importers in 2015



Source: Data from UNComtrade-WITS

Figure 21 shows major importers of "other manufactures"; the top five importing countries are the United States with 17.76 per cent, Germany with 7.44 per cent, China with 5.65 per cent, the United Kingdom with 4.75 per cent and France with 4.42 per cent. Like textile and manufactured products, the United States (with 10.48 per cent), Germany (6.5 per cent) and China (7.93 per cent) are top importers of basic food (see Figure 22). That could suggest that potential importers for Myanmar new products are geographically a mix of North America, Europe and East Asia. Geographically, East Asia could be the most accessible, given Myanmar location and already established trade relationship with major importers such as China and Japan. However, it does not mean Myanmar need not seek to enter Europe and North America even though challenges such as logistics and meeting high standard requirements for quality are inevitable.

Figure 22: Share of Basic Food Importers



Source: Data from UNComtrade-WITS

In 2016, Myanmar was ranked 113th out of 160 countries in World Bank's logistics performance index (LPI), which could be considered as an improvement as Myanmar was ranked 145th in 2014. However, improvements in logistics are much needed to access higher-end markets such as Europe, the United States and Japan. Along with improvement in logistics, trade facilitation will also play an important role in promoting Myanmar exports. Shephard (2009) suggests that a 10 per cent increase in trade facilitation, "considered as the full set of policy measures used to reduce the costs of trading internationally", is correlated with a three to four per cent product diversity gain.

Not just in product diversification, similar patterns are also observed in market diversification, as a 10 per cent increase in trade facilitation can lead to a five to six per cent increase in the number of foreign markets. In fact, trade facilitation can promote the diversification of exports through reducing trade transaction costs. It is inevitable to face costs such as legal and administrative fees when starting a business. Indeed, costs are not confined only to money but also time, for instance, time to get licenses/permits. Hence, higher entry costs, both in terms of money and time, can result in fewer producers leading to fewer export products. As this study's focus is not on diversifying to new markets, details on this issue are not further analysed. Accordingly, diversifying markets could be another study to complement this one, and other studies that assert that *where* you export matters as much as *what* you export.

7 CONCLUSION

Diversification is important for Myanmar's productive structure since exports are concentrated mainly in a few product sectors and markets. Myanmar's geographical (or market) orientation is not currently favourable, since it orientates towards slower import growing markets while sectoral composition does not clearly suggest that Myanmar is positioning on fast growing products. This calls for a need to diversify product base and markets. Using the revealed comparative advantage (RCA) measure developed by Balassa (1965), this study analyses which Myanmar products have comparative advantage (as in 2015), and compares how this comparative advantage has changed from 2010 to 2015. This study finds that Myanmar's RCA lies in precious stones, pearls and gold, fuel, basic food, agricultural raw products, and textiles.

However, Myanmar's average comparative advantage has decreased between 2010 and 2015 due to a sharp drop in precious stone extraction, pearls and gold, and agricultural raw products. In general, Myanmar comparative advantage is hampered due to its concentration in less complex products. By operationalising concepts of economic complexity and product ideas developed by Hausmann et al. (2007) and Hidalgo et al. (2007), this study finds that Myanmar's potential

products that can be exported competitively are products from textiles and 'other' manufactures group – suggesting that Myanmar should move from primary sectors to manufacturing sectors.

This study also employs parsimonious transformation strategy and strategy bets quantitatively developed by Hausmann et al. (2014) to identify potential products that could be produced in both the short and long term. In employing a parsimonious strategy, this study is able to identify products which are relatively close to Myanmar's current product space, and whose production may lead to creating more jobs. By strategy bets, this study is able to identify products which are relatively far away from Myanmar's current product space, but producing such products can create better jobs as they require more sophisticated capabilities. Hence, in the short term, this study suggests making and exporting products identified by a parsimonious transformation strategy while products identified by strategy bets can be aimed at long term prospects. The majority of the products identified by both strategies are from textiles and other manufactures, but products developed by the parsimonious strategy are less complex than those identified by strategy bets. In addition, basic food products could be another sector that Myanmar should focus. As shown in panel E of Figure 8, Myanmar's food products could move to the core area of the product space if significant competitiveness is achieved in this sector. Myanmar can learn from Thailand's product space, that food products with value added activities can increase the complexity of its product space.

The findings in this study trigger some implications for Myanmar's policy makers to promote export growth. First, there needs to be **a better collaborative and coordinating mechanism among all relevant stakeholders**. At the policy making level, promoting export growth through diversification cannot be done by one ministry as it requires the collaborative effort of all concerned ministries since challenges in trade development such as the export licensing regime, logistics services and infrastructure, the quality of exports, trade finance, labour issue, etc., cannot be handled alone by the Ministry of Commerce, the focal ministry for trade development alone[26]. In addition, collaborative effort between the public and private sectors is also required, since public-private dialogue could be only way to identify constraints that producers face; in addition, it could also serve as a platform for policy makers to inform the private sector regarding recent developments of trade initiatives – for instance, Myanmar's commitments to the WTO Trade Facilitation Agreement[27]. Linking back to feasible products identified

26 An action matrix on trade policy in Diagnostic Trade Integration Study (DITS) of World Bank (2006) details specific constraints that can be tackled by related ministries.

27 Myanmar ratified the WTO-TFA in December 2015, and the agreement came into force in February, 2017. For more information on Myanmar's commitments, please see http://www.commerce.gov.mm/eif/en/content/111

in this study, policy makers can identify specific challenges for instance in textiles, and basic food products to advance in the product space. Without knowing specific hurdles that producers (the private sector) face, it is not likely that policy makers can deliver effectives policies/strategies for trade development.

Second, there is **an important role of trade facilitation** in diversifying Myanmar's products. As discussed above, trade facilitation can help Myanmar increase both product diversification and market diversification as it reduces trade transaction costs. Lower transaction costs encourage new businesses to enter into markets – resulting in more exporters/producers. Currently, the cost of starting a business in Myanmar is relatively high as it is ranked 146 out of 190 countries in "Starting a Business" indicator of the World Bank's "Doing Business Survey 2017" but it has improved when compared to 2016 as it jumped from the rank 170 (World Bank, 2016). Indeed, potential products would not be produced if costs were higher to enter into the domestic markets, and higher costs are big hurdles for both foreign and domestic investors[28].

Third, **proper incentive mechanisms for investors** are required. Preferential incentives should be given to investors in specific sectors with higher return in complexity and opportunity gain. By contrast, no preferential incentives should be given for investments in sectors with lower returns. In the case of Myanmar, policy makers need to provide an enabling business environment for investments in manufacturing, since this analysis reveals that certain manufacturing products are not far away from product space to produce. Such kind of incentives could include providing tax incentive for feasible products, along with reducing trade costs as mentioned previously. Likewise, no preferential incentives for natural resource products should be given. Indeed, higher export taxes could be levied on raw natural resource products since they have lower returns.

Fourth, there needs to be **proper mechanisms to promote the role of the private sector in infrastructure**. Myanmar has one of the lowest electrification rate in the world, road networks are quite underdeveloped, and along with undeveloped logistics services and quality infrastructure broadly, leading to impede productivity. As acknowledged in the previous section, feasible major importers are high-end markets, and those markets will demand that Myanmar products meet their higher standards for quality. Hence, to enter into these markets, better logistics infrastructure and quality infrastructure are required. Traditionally, the provision of these services could be considered as public goods. However, there is a role for the private sector, not limited to only domestic actors, to participate in providing infrastructure due to growing demand of needed infrastructure in the trade sector. In fact, the rationale behind the role of the

28 It is important to note that Myanmar's overall rank for doing business is 170 currently; 171 in 2016.

private sector in providing infrastructure and public services provision is "the poor performance and mismanagement characterising most publicly-owned and operated utilities" (Panayotou, 1997, p.49). Nonetheless, it does not necessarily deter the role of government in infrastructure since the government is the only entity that will frame the legal and regulatory basis for providing infrastructure. Different mechanisms such as management contracts, lease concessions, build-operate-transfer (BOT) and private-public partnerships are all available to increase the role of the private sector in infrastructure provision. Myanmar has already employed such mechanisms in basic infrastructure such as in road networks. Nonetheless, there is growing demands for trade infrastructure such as bonded-warehouses, logistics parks, inland container depots, and so on. Hence, it is left to policy makers to determine which types of infrastructure could be developed through private sector participation, and what mechanism could be employed to ensure the best outcomes. Indeed, it is also crucial to increase more foreign direct investment (FDI) as it is also crucial to include role of foreign investors in infrastructure.

Fifth, there is **an important role for improved human capital** in diversifying Myanmar's exports. As shown in our analysis of the product space, more complex products require more capabilities. Even if other required setups such as coordination and trade facilitation mechanisms, and trade related infrastructure are in place, it would not be possible to export sophisticated products without a proper pool of human resources. Even though returns from investment in human capital cannot be realised in the short term, the creation of new high added-value activities and the export of sophisticated products requires improved training, and a better education system. Indeed, a better education system is the only solution to improve the capability of Myanmar's human resources. A better pool of human capital is required more in the service sector, as services sophistication can increase the productive structure more than the case of simple goods, as documented by Stojkoski et al. (2016). Even though the service sophistication literature is at very nascent stage, it is undeniable that skills required in service sector, for instance, finance and information technology, are quite complicated. In fact, the more sophisticated the capabilities, the more complex the goods/services. Hence, it is important to invest in human capital to improve Myanmar's position in product space.

To conclude, this study identifies new products to diversify Myanmar productive structure based on the supply side, but much work is still required to complement this study. For instance, challenges likely to be faced by making/exporting products identified in this study should be further explored. This study generally acknowledges possible importers for Myanmar's potential products, however, detailed analysis on accessing those potential markets is also required.

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INFRASTRUCTURE FINANCE FOR MYANMAR: A BRIEF INTRODUCTION OF THE LANDSCAPE

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SUMMARY

Infrastructure has manifold definitions and benefits. This policy brief discusses unique analytical characteristics of infrastructure and summarizes some empirical evidence on the nexus between infrastructure and economic development in developing countries. Then, this brief presents the current state of infrastructure development in Myanmar with the focus on the role of strategic planning and the need to develop a systematic and cross-sectoral approach to project screening and selection at the national level. Lastly, the brief provides an overview of costs and benefits associated with different financing options available for infrastructure projects in Myanmar.

DEFINING INFRASTRUCTURE

*You and I come by road or rail. But **economists travel** on **infrastructure***. (Margaret Thatcher, May 22, 1985)

There are myriad definitions of infrastructure. Even for the most conservative, definitions of "infrastructure" are legion (ADB 2017, Prud'homme 2005), ranging from transport infrastructure (roads, bridges, railways, airports, ports, waterways, dams and irrigation, canals, sewers), energy infrastructure (power turbines, oil and gas pipelines, transmission lines), communication infrastructure (telecommunication networks, phone lines, cyber optic connections) and so on (Prud'homme 2005).

Infrastructure has some unique economic characteristics. First, it assumes the form of capital goods. Sometimes, it enters into the production function as inputs. Sometimes, it provides services, in combination with labour and other inputs. Second, infrastructure is known for its lumpiness. The utility of a half-built bridge is close to zero. Third, infrastructure is space-specific, since a bridge or a road or a power station is attached to a particular geospatial location on earth, although the duration for its use may be long. Fourth, the services that infrastructure provides are often linked to cases of market failures, externalities and natural monopolies.

Myriad infrastructure has myriad benefits, with more pronounced benefits in the countries with the most basic infrastructure (Donaldson 2010, Jedwab and Moradi 2016). For example, in poor countries in Africa with the most basic transport infrastructure and high trade costs, initial investment in basic infrastructure produces the largest impacts on agricultural development, trade integration and structural change. In colonial India, the expansion of the railroad to the average district was associated with a 19 per cent increase in real agricultural income. Transportation infrastructure leads to a decrease in trade costs, interregional price differentials, vulnerability to local productivity shocks and volatility of real income and an increase in domestic and international trade, thus elevating the level of real income in the region.

Energy and communication infrastructure have demonstrably direct and substantive positive impacts on productivity, labour market performance and overall human flourishing. An increase in electrification provision is associated with gains in manufacturing output (Rud 2012) and higher levels of human development (as measured in the Human Development Index, Libscomb et al. 2013). In contrast, endemic blackouts are known to be anathematic to economic growth. For example, weekly blackouts in the Indian textile industry have led to a five per cent reduction of average output, with smaller plants suffering from larger losses (Allcott, Collard-Wexler, and O'Connell 2016). There is also heterogeneity in the impacts of shortages across sectors since the most energy-intensive industries are affected most severely by the shortages (Grainger and Zhang 2017). Similarly, telecommunication infrastructure also plays a prominent role in improving welfare in rural areas. The provision of public payphones among isolated villages in Peru led to an increase of 19.5 per cent in agricultural profitability and the reduction in child agricultural work by 26.3 per cent (Beurmann 2011).

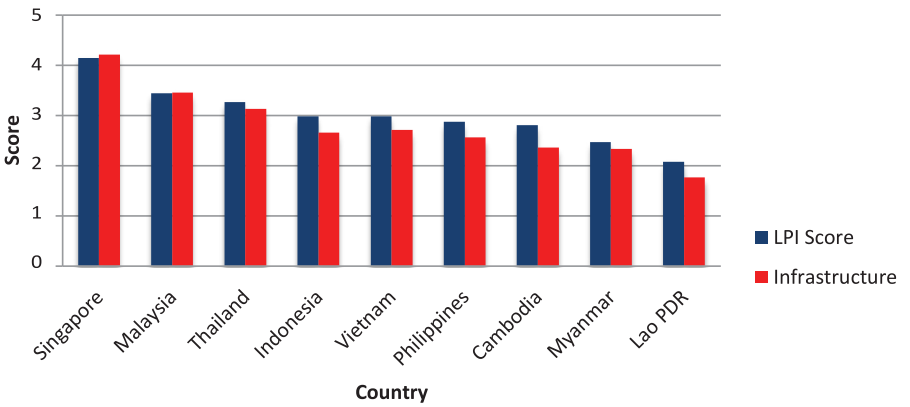
THE ROLE OF INFRASTRUCTURE IN MYANMAR

Myriad infrastructure also plays a critical role in bridging regional income equalities, one of the top priorities of Myanmar's new government. Recent evidence (Rexer 2018) suggests that states and regions in Myanmar are converging in terms of economic growth both within and across states over time (with the exception of Rakhine and Chin States), thus intimating the need for spatially targeted policies for lagged regions. The evidence in Rexer (2018) further stresses the role of infrastructure in both growth and the convergence of states and regions.

The study points to the significant role of major trunk roads on the convergence, and to a lesser extent, the effect of railways. Most importantly, the study highlights the relative importance of domestic market integration in alleviating regional income inequalities. The major policy implication of Rexer (2018), accordingly, is that transport infrastructure should be designed to link remote areas with both border trade centres and major metro areas in the framework of connecting missing links in Myanmar.

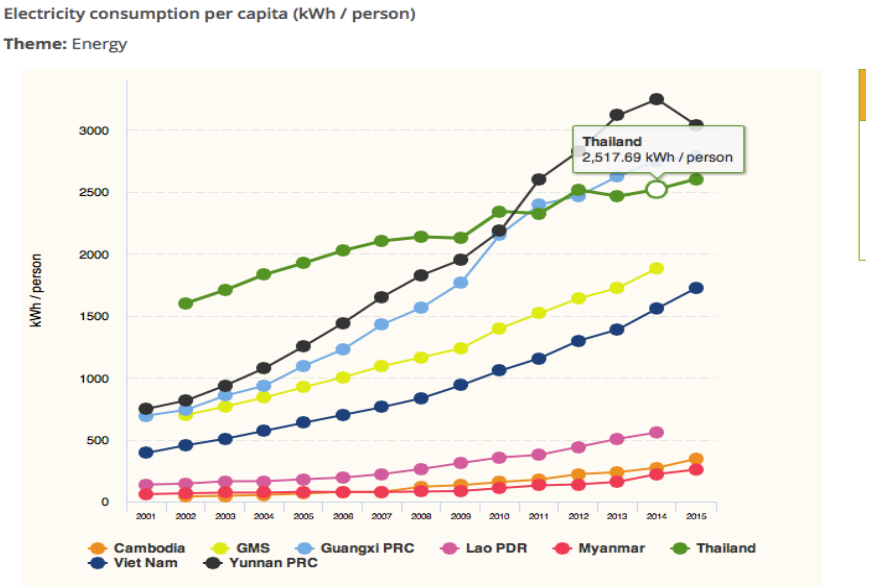
Rapid development of infrastructure in Myanmar will have rapid, robust and rigorous impacts on economic growth and the welfare of the people in the country given that infrastructure in Myanmar is, by and large, still an early stage of development. As per the Global Infrastructure hub and Oxford Economics (2017), Myanmar has the lowest Infrastructure stock per person for all low-income countries (in a sample of 50 such countries). Myanmar also has the lowest "power" stock per person, and the fourth lowest "road" stock per person, trailing behind Kenya, Ethiopia, Vietnam, Bangladesh, Cambodia and Egypt. Similarly, compared to its peers in ASEAN and the Greater Mekong Sub-region, Myanmar has consistently underperformed across a whole spectrum of indicators on infrastructure from infrastructure risks, logistics performance, electricity consumption per capita, road density and so on.

Figure 1: Logistics performance score and infrastructure score amongst ASEAN countries



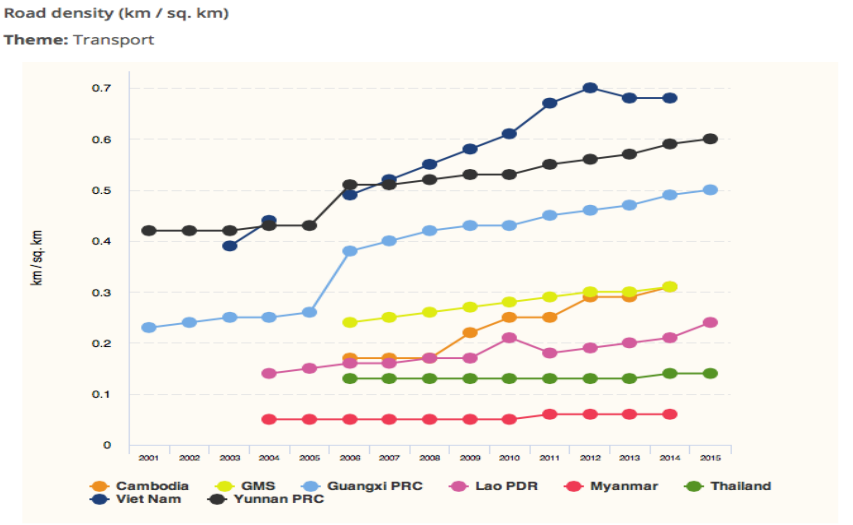
Source: World Bank 2016

Figure 2: Electricity consumption per capita in selected regions and countries in Greater Mekong area



Source: https://greatermekong.org/statistics/

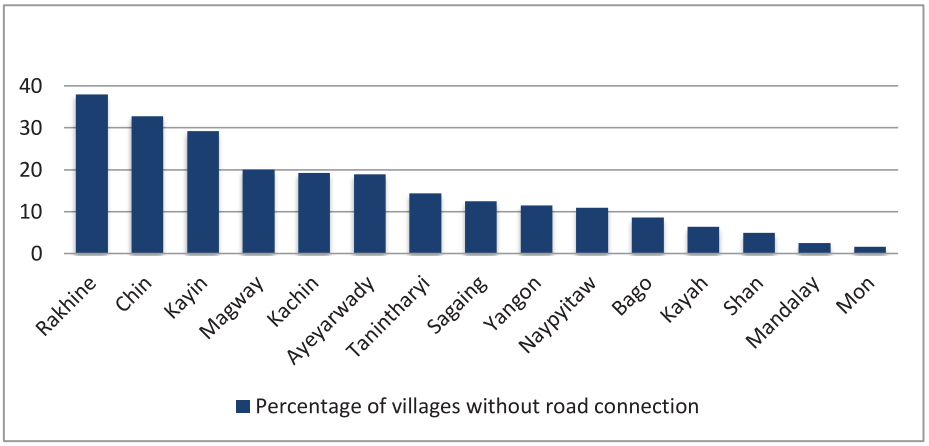
Figure 3: Road intensity in selected regions and countries in Greater Mekong area



Source: https://greatermekong.org/statistics

Villages in Myanmar suffer from an acute scarcity of connecting roads. This scarcity has more prominently manifested in some regions than others. For example, in Rakhine and Chin, more than 30 per cent of the villages have no road connections.

Figure 4: Percentage of villages without road connection



Source: ADB 2016

STRATEGIC PLANNING FOR INVESTMENT PROJECTS IN MYANMAR

This aforementioned severe shortage of infrastructure translates into an acute need to boost up investment in the sector. As illustrated in the report by the Global Infrastructure Outlook (2017), Myanmar has one of the largest investment gaps in infrastructure including power, transport and telecommunication (the gap between current investment trend and the investment needed) to meet the Sustainable Development Goals (SDGs) in 2040, with an annual average investment gap of 5.11 per cent of GDP (Global Infrastructure Hub 2017). According to the ADB (2016), Myanmar needs to spend three to four per cent of its GDP in investments in the transport sector alone, which is two to three times higher than historic levels, and amounts to USD 60 billion over the next 15 years.

Given the immensity of need for infrastructure investments in Myanmar, a sustainable investment strategy for infrastructure is both timely and much needed. Myanmar has three primary instruments at its disposal to mobilise financial resources for infrastructure investments: budget, official development assistance, and private-public partnership (PPP)/private sector.

Under pressure to maintain fiscal prudence, official budget allocation to infrastructure-related ministries declined from 31.07 per cent of the budget share in 2016-2017 fiscal year to 27.91 per cent in 2017-2018 fiscal year. (Citizens Budget, 2016 2017) There may be a need to realign budget allocation of the government to reflect its policy priority for basic infrastructure. Moreover, all possible sources of infrastructure financing need to be explored systematically and strategically to optimise the delivery of infrastructure to the people of Myanmar.

To this end, the Government of Myanmar is now working its way towards the establishment of a Public Investment Programme (PIP). Under the rubric of the PIP, the Government plans to design a general policy framework with clear guidelines and principles for project screening and financing. The Ministry of Planning and Finance (MoPF) is now working with relevant line ministries to draft a cross-sector and cross-ministry infrastructure investment plan to consolidate and prioritise national infrastructure projects consistent with Myanmar Sustainable Development Plan and Medium-Term Fiscal Framework.

The flow of Official Development Assistance (ODA) into infrastructure is expected to increase dramatically over the next few years, and the Government of Myanmar is now taking a more proactive and strategic approach to development assistance with the establishment of the Development Assistance Coordination Unit (DACU). DACU has been coordinating with relevant line ministries and partners in development to direct development assistance into the rapid development of basic infrastructure. For example, the majority of development assistance from Japan, which is estimated to be no less than USD 9 billion over the next few years, will be directed towards building basic transport and social infrastructure such as those related to basic education, primary health care, nutrition, safe water and sanitation to spur domestic production and job creation.

TAKING THE HIGH ROAD

However, the road to better infrastructure in Myanmar with the ODA is now facing major implementation challenges. Three major financiers of infrastructure such as the Asian Development Bank (ADB), JICA and the World Bank are grappling with abysmally low disbursement rates in their infrastructure projects, with a three per cent disbursement ratio of ADB projects in FY15 and five per cent in FY16 (to June), well below preferred levels (MoPF 2017)[29].

Similarly, for the WB and JICA, the disbursement rate for their entire portfolios revolve around the lower end of 10 per cent. The disbursement ratios for the

29 Interview with the officials of the MoPF.

WB's agriculture rehabilitation project and the national electrification project have been substantially lagging far behind the average disbursement rate. Weak institutional capacity in project management to process large and technically complex contract packages and protracted decision-making due to fragmented responsibilities, and rigid internal approval requirements within the government, have been traditionally nominated as potential factors for slow disbursement. However, complex and labyrinthine procurement and financial standards and rigorous safeguard measures for ODA projects may also have contributed to the delays in the implementation.

To facilitate effective delivery of development assistance, the Government of Myanmar has recently launched its National Development Assistance Policy to streamline and standardise internal approval requirements of the government. The Government is also in the process of finalising the National Procurement Law to provide a consistent and coherent legal framework for public procurement.

The Government of Myanmar, in its entire constellation of governmental bodies, should pay close attention to the whole spectrum of costs and benefits of different financial instruments from a diverse group of bilateral and multilateral institutions. For example, financial instruments from Chinese policy banks and export-import banks proffer certain advantages over other available instruments, albeit they also present a unique set of risks for infrastructure financing.

First of all, given the immensity of investment needs in infrastructure, financial instruments provided by policy banks provide a great source of liquidity with a lower cost of capital since they are not subjected to the same capital adequacy ratios[30] as other financial institutions, and they only seek to cover operational and financial cost. Second, they present somewhat liberal conditions for compliance and transparency. Since they are not beholden to the guidelines for officially supported export credit, policy banks are able to offer preferential terms and conditions to clients (Lee et al. 2014).

However, this particular path to infrastructure financing should be directly informed by a careful and systematic analysis of economic and financial viability of the projects, and the whole spectrum of risks (political, social, economic and environmental) emerging from the implementation of the projects. Infrastructure financing of this nature also has the tendency to lock the borrowing country into procuring goods, services and technologies from the source country. From the perspective of the borrowing country, there may also be some limitations in transparency in the valuation of goods and services and tendering processes.

30 It is a measurement of the amount of capital of a given bank expressed as a percentage of its risk-weighted credit exposures.

Some financial instruments with arrangements to provide the loans 'in-kind' and repayment in a convertible hard currency may also expose the country to exchange-rate risks, thus potentially nudging the country towards the risk of macroeconomic instability.

Given that there is a plethora of Private-Public Partnership (PPP) mechanisms available for infrastructure financing, the government of Myanmar needs to mobilise financial resources for infrastructure investments via these mechanisms. Although multiple line ministries and states/region governments have been implementing PPP projects in a wide variety of sectors including electricity, energy, aviation, roads, water, waste treatment and hotels, there is neither a clear policy framework nor a single definition of PPP in Myanmar. The line ministries have been engaged in a multitude of independent and autonomous negotiations and agreements without clear, coherent and consistent project screening, evaluation, procurement and implementation guidelines.

As such, there may be a dominance of unsolicited projects with dubious financial and economic viabilities in the PPP space. Unregulated and ad-hoc policy decisions that governed the past PPP landscape could have serious macroeconomic consequences. Moreover, in unique contradistinction to its neighbours, there is no dedicated PPP unit or agency within the Government of Myanmar. To fully benefit from the availability of PPP mechanisms for infrastructure financing, the Union of Government needs to move quickly in formulating a clear and coherent PPP policy and institutional framework to regulate and harmonise PPP transactions across the entirety of government. The PPP unit could play an important role in making a systematic assessment of the costs and benefits of a whole spectrum of PPP structures such as BOT (Build, Operate, Transfer), BTO (Build, Transfer, Operate) and Joint Venture (JV) while gauging sector-specific suitability of these mechanisms. The Government should also consider the provision of specific and targeted fiscal incentives to facilitate the participation of the private sector in infrastructure development at different stages.

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LABOUR PRODUCTIVITY, POTENTIAL OUTPUT AND OUTPUT GAP: A USEFUL TOOL FOR BUDGETARY SURVEILLANCE AND FISCAL POLICY OF MYANMAR

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SUMMARY

An output gap suggests that an economy is running at either overutilization or underutilization of its resources. In other words, output gap indicator enables to monitor the overheating or underperforming of economy and coordinate required economic activities through the effective policy. The potential output is measured based on unemployment gap, potential investment and trend total factor productivity (TFP) capturing full capacity utilization. Accordingly, it has become critical in the conduct of monetary and fiscal policies. The present study investigates TFP, potential output and output gap of Myanmar for the period 1990-2015 using quarterly data with 104 observations and draw policy implications. Since the direction of nonaccelerating inflation rate of unemployment (NAIRU) in the study is falling that indicates the success of an economic reform process – the decline of unemployment gap and inflation. It also suggests alternatively that Government may need to design to close or narrow the output gap using expansionary fiscal policy such as spending or lowering taxes to raise aggregate demand when the signals are received.

OUTPUT GAP

The output gap is defined as the difference between the actual output of an economy and its potential output (expressed as a percentage of potential output). Potential output indicates the maximum amount of goods and services an economy can produce at full capacity utilisation. Thus, potential output shows the production capacity of the economy without incurring in inflationary pressures. The output gap can be expressed as follows:

$$\text{Potential Output} = \frac{GDP_t - GDP_t^*}{GDP_t^* \times 100}$$

where GDP shows actual gross domestic product and GDP* indicates the potential GDP.

A positive output gap occurs when actual output is larger than full-capacity output. In contrast, a negative output gap arises when actual output is less than country's full capacity output. A negative gap points to the fact that there is spare

capacity, or slack, in the economy due to weak demand. An output gap suggests that an economy is running at either over-utilisation or under-utilisation of its resources. In other words, output gap indicators enable policy makers to monitor the overheating or underperforming of economy, and coordinate required economic activities through effective countervailing policy.

If the output gap is positive over time then, all else equal, prices will begin to rise in response to demand pressure in the economy. Similarly, if actual output falls below potential output over time, prices will begin to fall, reflecting this weak demand. In the European Economy, the output gap approach is used, as determined by the "Output Gap Working Group" under the EU's Economic Policy Committee. Together with other measures to monitor and coordinate the cyclical nature of its member states, it administers the framework of the Growth and Stability Pact (GSP) in which the original public finance target of GSP 1997 included a three per cent maximum headline budget deficit balance, and a 60 per cent/GDP aggregate debt ceiling.

The potential output of an economy is measured based on the unemployment gap, potential investment and trend Total Factor Productivity (TFP), all of which is captured as full capacity utilisation. It has become critical in the conduct of monetary and fiscal policies. The nonaccelerating inflation rate of unemployment (NAIRU) has been defined as the unemployment rate consistent with a constant rate of inflation. Deviations of the unemployment rate from the NAIRU are regarded as deviations of output from its potential level. Accordingly, if policymakers set the actual unemployment rate at the NAIRU, the economy will produce at its maximum output level without straining resources. Then there will be no output gap and no inflationary pressure.

In estimating potential output, the most commonly used methodologies include:

(i) Time series approaches such as split time-trend methods and univariate filters such as the Hodrick-Prescott and Kalman filters;
(ii) The production methodology, currently extensively employed in the 28 member states of European Economy[31];
(iii) Bayesian methods;
(iv) The multivariate filter approach.

The present study investigates TFP, potential output and the output gap of Myanmar for the period 1990-2015 using quarterly data with 104 observations

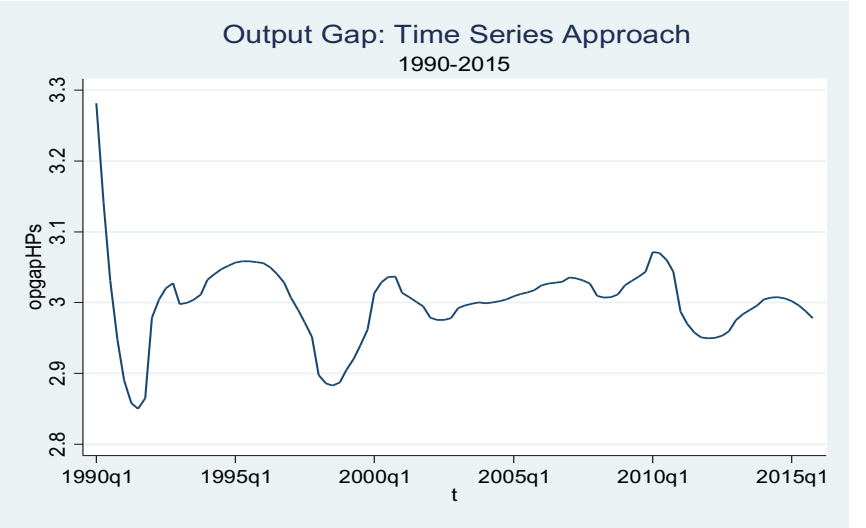
31 Since the production function methodology has been updated in 2014, 22 members have started to apply the Kalman filter in the framework of New Keynesian Phillip Curve approach with rational expectation inflation hypothesis, while six other members continued to use the existing methodology, in particular, the traditional Keynesian Phillip Curve' with adaptive expectation framework.

and draws policy implications. It employs the first two approaches above for simplicity in estimation and feasibility in the economic interpretation of results. Real GDP and capital formation are sourced from the World Bank meta data; capital stock data is based on the IMF's capital and investment dataset – while employment and working age population data are constructed using geometric interpolation method based on the population census of Union of Myanmar Government for 1993 and 2017. The employment and unemployment rates are based on Myanmar's Central Statistical Organization (CSO) Yearbooks.

Method 1: Estimating Potential Output and Output Gap using Time Series Approach

The most widely used time series method of measuring potential output is the Hodrick-Prescott (HP) filter, which separates the short from the long term. It yields a trend output estimate that simultaneously minimises a weighted average of the gap between output and trend output, and the rate of change in trend output under study.

Figure 1: Output Gap (%) of Myanmar using H-P Filter



The framework used for estimating potential output in the present study is based on the OECD Secretariat's supply modelling work, as described by Torres and Martin (1989) and Torres et al. (1989). It has been suggested that the HP filter method also has endpoint problems. This reflects the fitting of a trend line symmetrically through the data. If the beginning and the end of the data set do not reflect similar points in the cycle, then the trend will be pulled upwards or

downwards towards the path of actual output for the first few and the last few observations (data). Other weakness of the method is the treatment of structural breaks, which are typically smoothed over by the HP filter, moderating a break when it occurs, and spreading its effect forwards and backwards over several years. The study of Karel et al. (2014) discussed the current use of Kalman filter in the European Economy, and its relevance for representing capacity utilisation framework.

Method 2: Estimating TFP, Potential Output and Output Gap using Production Methodology

The production function method applied by the Cobb-Douglas production function that calculates output based on a country's factors of production, such as labour, capital and technology.

$$Q(L,K) = A\, L^{\alpha}\, K^{\beta} + u \qquad \text{..... (1)}$$

where 'A' denotes trend total factor productivity (TFP), in the framework of Solow's growth model, K indicates potential capital stock and L shows the employment. α and β are the output elasticities of labour and capital. First the tests for unit root and cointegration are conducted to examine stationary of time series and rank of cointegration using Phillips-Perron unit root test and Johansen test for cointegration. Second, log-linear model of Eq (1) is estimated and save the residuals of regression as Solow's residuals which referred to as TFP. Third, trend-TFP is estimated decomposing TFP into cycle and trend components using Kalman filter.

The Potential GDP is examined by estimating log-linear form of production function Eq. (2) with using trend- TFP, potential labour (L^{*}) and potential investment (K^{*}).

$$Q^{*}(L,K) = A\, L^{*\alpha}\, K^{*\beta} + \varepsilon \qquad \text{..... (2)}$$

where 'A' denotes trend-TFP, K^{*} indicates potential capital stock, and L^{*} shows potential employment. The level of potential employment is calculated as:

$$NAWRU = U - (DU/D3logW) * D2logW$$

$$L^{*} = LFS\,(1 - NAWRU) - EG \qquad \text{..... (3)}$$

where LFS: smoothed labour force (the product of the working age population and the trend participation rate)

NAWRU: non-accelerating wage rate of unemployment

EG: employment in the government sector.

D2 and D3 indicate the second and third differencing operators of variables.

The potential employment is defined as the level of labour resources that might be employed without resulting in additional inflation. It adjusts actual labour input for the gap between actual unemployment and the estimated NAWRU level. Finally, the potential investment K^* is calculated as the fixed capital formation/ GDP ratio. Trend-cycle decomposition of TFP rates are depicted in Figure 2.

Figure 2: Trend-Cycle Decomposition of TFP (%)

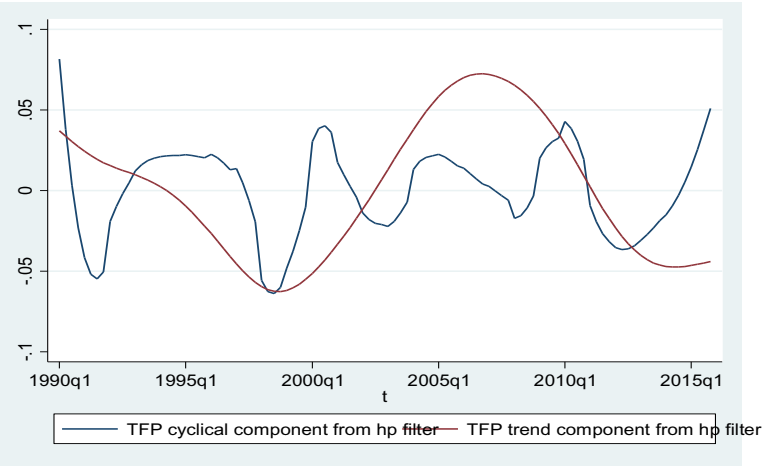
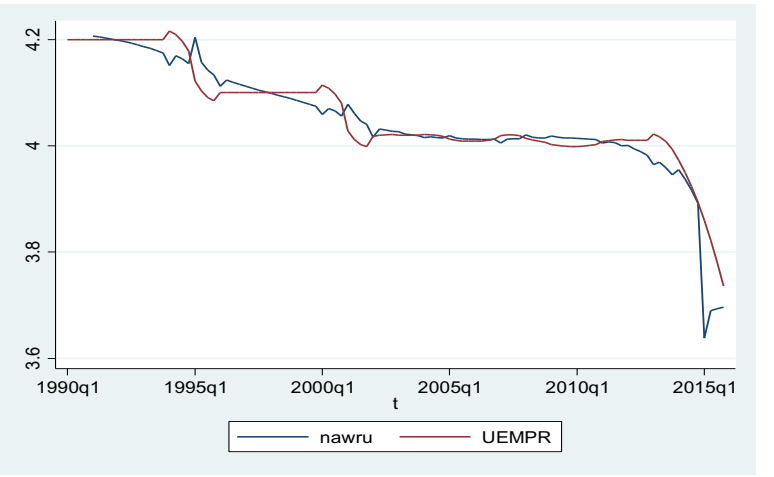


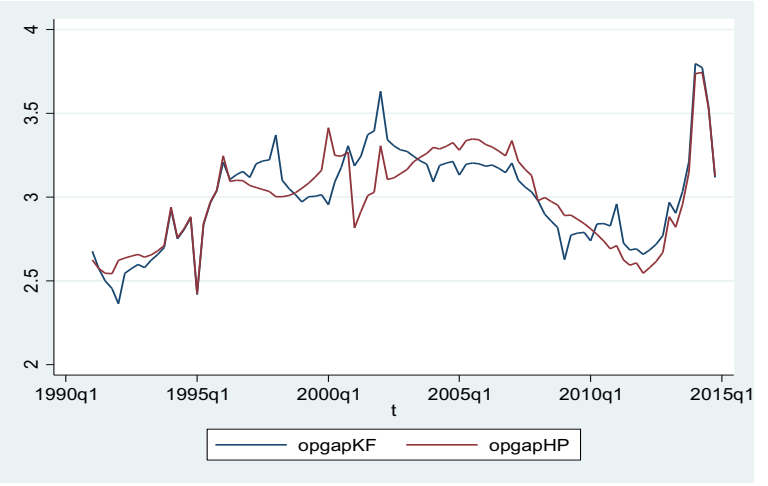
Figure 3: Unemployment Rate and NAWRU (%)



It has been widely accepted that the extent and direction of a falling NAWRU is an indication of the success of an economic reform process – the unemployment gap, that is, the gap between NAWRU and actual unemployment, narrows. Figure 3 depicts the changing patterns of this gap in Myanmar.

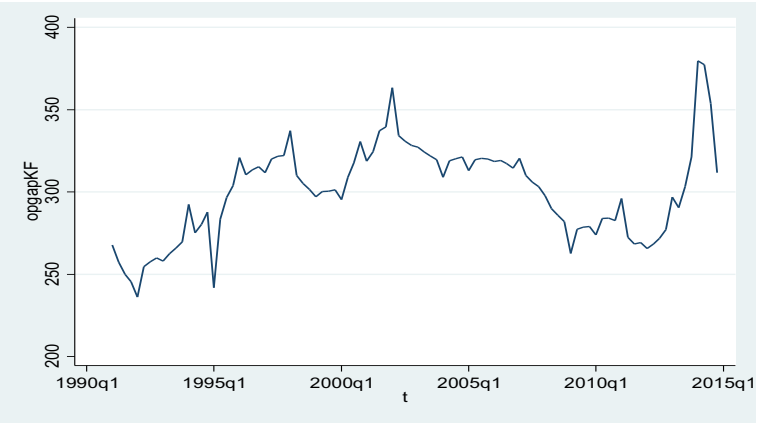
In estimating the TFP, potential output and output gap, this study employs both H-P and Kalman filter methods. The results are reported in Figure 4. The output cycle provides short term transitory influences, underlying imbalances or structural positions in the macro economy. State Space modelling is applied to obtain smoothed series under Kalman filter applying state space modelling, while the H-P filter is relatively straight forward in the STATA programme.

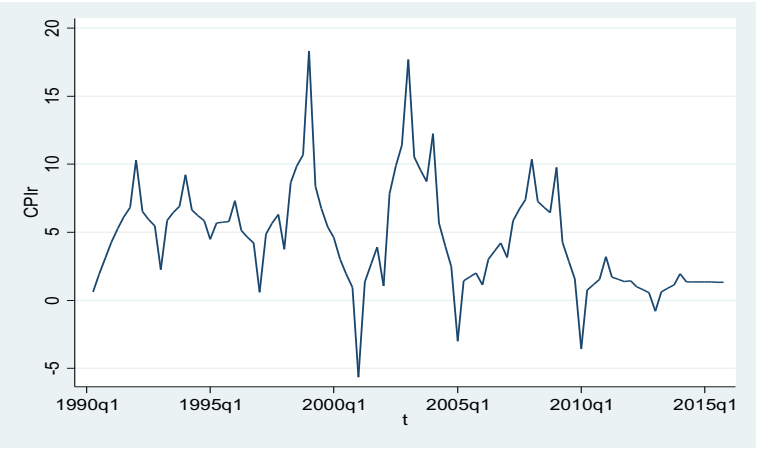
Figure 4: Comparison of Output Gap (%) under HP Filter and Kalman Filter



When the output gap is zero, there is no upward or downward pressure on inflation, as actual demand matches the economy's potential. If the output gap is positive (+) inflation will begin to rise in response to demand pressures. If the output gap is negative (-), prices will begin to fall to reflect weak demand.

Figure 5: Correlation of output gap (panel A) and inflation patterns (Panel B)





Policy applications of the results

The production methodology approach to output gap is widely used as an operational 'Surveillance Tool', and for government budgetary surveillance purposes in Treasury departments to monitor structural budget balances. As discussed above, when the economy may be overheating or underperforming, it has immediate implications for monetary policy.

From the monetary policy perspective, below-potential performance signals a central bank to adopt a monetary policy designed to stimulate economic growth

by lowering interest rates – to boost demand while preventing inflation from falling below the central bank's inflation rate target. An overheating case generates upward pressure on inflation and may signal that the central bank should act to "cool" the economy by raising interest rates.

From the fiscal policy perspective, Government can design to close or narrow the output gap using expansionary fiscal policy, such as spending or lowering taxes that would raise aggregate demand. When there is a positive output gap, the signal for government is to adopt contractionary or tight fiscal policies to reduce demand and combat inflation through lower spending and/or higher taxes.

There exist limitations in the use of this method. In developing countries including late members of the European Economy (and countries such as Myanmar), structural changes have occurred, and so the use of output gap analysis needs some caution. Since there exists alternatives in estimating output gap methodology, differences in source of data, model specification and forecasts can lead to some differences in results. Other methods such as Bayesian analysis and multivariate filter can also be applied, however, these may impose limitations for policy makers due to the complexity of methodologies and interpretation of results.

In brief, the methodology outlined here reflects a relatively powerful tool to monitor the association among key indicators: TFP, output gaps, structural budget balance, unemployment and inflation, and the subsequent coordination of the economic policies and activities across ministries and or sectors.

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THE ELECTION FEVER OF CONSUMER PRICE INDEX IN MYANMAR

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SUMMARY

In the eyes of political economists, politics matters for the economy and economics matters for the political arena. But amongst the things that also matter for people, especially the poor, is the general level of prices that determine their cost of living which is measured, broadly, by the Consumer Price Index (CPI). The aim of this study is to review the trends in CPI pre- and post-2015 election in which the majority of voters united under the banner of the National League for Democracy (NLD). In this regard, the interrupted time series analysis can be conducted for univariate CPI series in which the breakpoints in the CPI trend can be tested for election seasons. The study finds that inflation increased at election season out of trend in terms of CPI and food CPI, and rejects the deviation of trend at some other points of time for other reasons. The non-food CPI was not affected directly by the election for which other factors matter more.

DATA AND METHODOLOGY

This article applies the interrupted time-series analysis (ITSA) as the key methodology to observe the impact of election season on the consumper price index (CPI) in Myanmar by using 60 monthly time series dataset (2013-2017) compiled by the Central Statistical Organization (CSO). The ITSA model is the most flexible and appropriate one this study, as it offers a quasi-experiment research design with a potentially high degree of internal validity (Campbell, Shadish & Cook 2002).

The standard ITSA regression model for this study can be written as follow:

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_1 + \beta_3 X_1 T_t + \beta_4 X_2 + \beta_5 X_2 T_t + \beta_6 X_3 + \beta_7 X_3 T_t + \epsilon_t$$

Y_t is the outcome variable (monthly consumer price index). In this study, the consumer price index (CPI), consumer price index for food basket (food CPI) and consumer price index for non-food basket (non-food CPI) are used as integrated outcome variables. T_t is the time since the start of this study, X_1 is a dummy variable representing the first breakpoint at August 2015, one month before the startpoint of election campaigns (pre-election campaign 0, otherwise 1), X_2 is a

dummy variable for the second breakpoint at December 2015 (pre-election 0, otherwise 1), X_3 is another breakpoint dummy variable at April 2016 (pre-inauguration of new government 0, otherwise 1), and X_1T_t ,X_2T_t and X_3T_t are the interaction terms.

This study estimates these coefficients by using two different models: ordinary least square (OLS) regression and generalised least-squares (GLS). The Newey-West standard errors are applied in estimation results by OLS regression in which error terms are assumed to be heteroscedastic and possibly autocorrelated to some lags. The Prais-Winsten and Cochrane-Orcutt regression is used to estimate the parameters by GLS in which the errors are serially correlated and follow the first-order autoregressive AR (1) process.

RESULTS AND FINDINGS

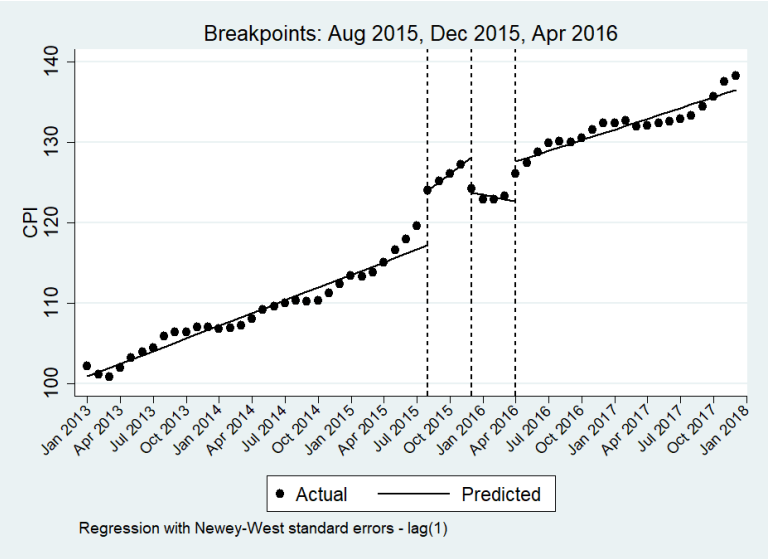
The interrupted time-series analysis (ITSA) results of three different outcome variables (CPI, food CPI and non-food CPI) are described in Table 1. The CPI seems to be sensitive to the election and three breakpoints defined in this study are reasonable, as all coefficients under the OLS method with Newey-West standard errors are significant at 0.1 per cent level with lag (1). However, the coefficients under the GLS method are not strongly significant at the interaction terms. The reason can be that the error terms of CPI are not strictly following the AR (1) process or are lacking of strict exogeneity.

Since univariate OLS models with Newey-West standard errors assumes heteroscedastic and autocorrelated error terms, a Cumby-Huizinga test is the appropriate one to test for autocorrelation at a specific lag order; this test also allows for conditional heteroscedasticity in error terms as well as for endogenous regressors (Cumby & Huizinga, 1990). As stated in Table 2, the alternative hypothesis is rejected starting from lag (2) at one per cent level of significance for all three series, which means the autocorrelation is present at lag (1) but not at higher lag orders. Therefore, the lag order is specified as (1) for Newey-West standard errors.

When the trend of CPI is analysed at the three breakpoints with the OLS model as shown in Figure 1, it is obvious that the CPI is absoultely sensitive to election season. The CPI jumped up by 6.86 at the breakpoint of August 2015, the election campaign. It also had a positive slope change of 0.51 during the whole election campaign, resulting the post-breakpoint positive linear trend of 1.03 as described in Table 3. After the election period, at the breakpoint of December 2015, the CPI jumped down by 4.45 and had negative slope change of 1.31 during the post-election period. The post-election negative linear trend is 0.27 but the result is not significant. Once the new governement took rule, at the breakpoint of April

2016, the CPI jumped up again by 4.95 and had a positive slope change of 0.72, resulting in the new-government period positive linear trend as 0.44.

Figure 1: CPI



The second outcome variable, food CPI, is also assumed to be sensitive to the election case as almost all coefficients under the OLS method are significant with Newey-West standard errors of lag (1). However, the coefficients under the GLS method are not strongly significant at the interaction terms as for CPI. With reference to Figure 2, it is obvious that both the jump of food CPI at each breakpoint, and the slope changes after each breakpoints, are similar to the findings of the CPI trend as well. The upward jump at the breakpoint of election campaign is 10.64, and the slope chage is 0.74, which makes a campaign period positive linear trend as 1.49. The downward jump at the breakpoint of post-election is 7.52, and the negative slope change is 1.82. The resulting post-election negative linear trend is 0.34 but not significant. The next upward jump at the breakpoint of the new-government period is 8.23, and the positive slope change is 0.75, resulting in the new-government period positive linear trend as 0.42.

The third outcome variable (non-food CPI) seems to have a similar trend with the above mentioned two outcome variables (CPI and food CPI). However, the change in its trend at each breakpoint, and the slope of its trend, are not obvious as in the cases of CPI and food CPI. From Figure 3, the visuals show that there can be other breakpoints rather than election breakpoints, which means other factors or policy changes may affect the non-food CPI more than the election.

Figure 2: Food CPI

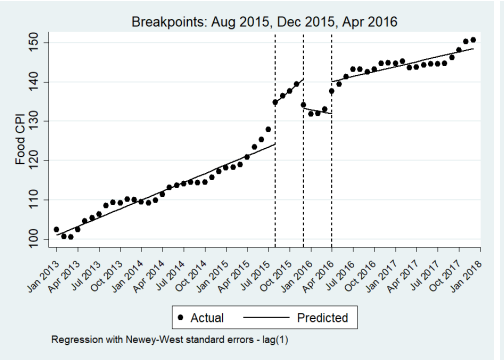
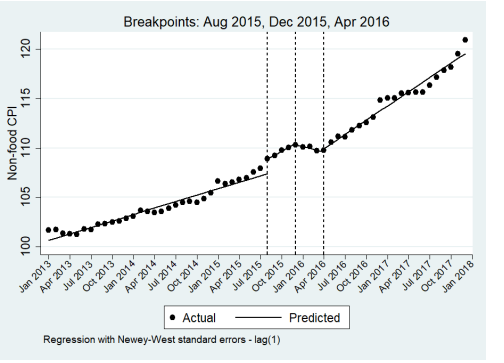


Figure 3: Non-Food CPI



CONCLUSION

According to the interrupted time series analysis conducted in this study, it is found that inflation increases at election season out of trend in terms of CPI and food CPI, and rejects the deviation of trend at some other points of time for other reasons. The non-food CPI was not affected directly by the election for which other factors matter more. Even though the evidence in this study cannot go further in finding out the source of jumps in CPI, it does suggest patterns in the behaviour of the economy and people during election seasons.

Election campaigns invariably involve rapid increases of expenditures in the economy, which raise the CPI and this was also the case in Myanmar, especially for food prices. Another important behaviour of people in an economy like Myanmar, which has faced different political crises since the independence of the nation, is that people buy and store food when they expect the possibility of political crises; the jumps in CPI and food CPI series reflect these concerns. The downward jump and rapid decrease in CPI and food CPI also signals that expenditures returned to normal after the assurance against the possibility of political crises when NLD won the election, and the transition seemed to be smoothly executed. The positive linear trend in both series after the new government assumed office can also reflect the normalisation of the economy, but the upward jump at the beginning should be examined further.

However, it is not fair to assume the election is the only reason for the breakpoints identified here, even though the breakpoints are statistically significant. Alternative explanations can be proffered when all possibilities of economically significant events around the breakpoints are considered. The first alternative can be built around the political business cycle theory to argue that the last-minute expenditures of governments right before the elections are likely to play

a role. As the fiscal year of Myanmar ends in March, the 2015-2016 budget must be spent by that time. The expenditures tend to be concentrated in the months before the election given that government functions tend to slow down during election period itself. The second alternative could be the severe flood that took place in Myanmar starting from mid-July 2015 and which affected 12 out of 14 states and regions. This involved the destruction of crops and properties, as well as the roll out of relief efforts, including food and non-food aid. Even after these two alternatives are considered, they can only explain the first breakpoint in August 2015, while the breakpoints in December 2015, and April 2016, still seem consistent with the election timeline.

Annex: Tables

Table 1: Interrupted Time-series Analysis of Consumer Price Index

	CPI (OLS)	CPI (GLS)	Food CPI (OLS)	Food CPI (GLS)	Non-food CPI (OLS)	Non-food CPI (GLS)
T_t	0.526***	0.568***	0.746***	0.815***	0.217***	0.214***
	(0.0334)	(0.0642)	(0.0523)	(0.0918)	(0.0148)	(0.0233)
X_1	6.855***	4.051***	10.64***	6.457***	1.501***	0.921*
	(0.688)	(0.654)	(1.057)	(1.054)	(0.264)	(0.390)
X_1T_t	0.507***	0.618	0.739***	0.994	0.178***	0.256
	(0.0349)	(0.369)	(0.0608)	(0.583)	(0.0246)	(0.200)
X_2	-4.448***	-4.020***	-7.516***	-6.819***	-0.143*	-0.142
	(0.343)	(0.759)	(0.596)	(1.236)	(0.0636)	(0.474)
X_2T_t	-1.306***	-1.383*	-1.821***	-1.964*	-0.578***	-0.657*
	(0.181)	(0.528)	(0.331)	(0.852)	(0.0352)	(0.310)
X_3	4.946***	3.063***	8.231***	5.093***	0.347	0.247
	(0.781)	(0.759)	(1.338)	(1.236)	(0.213)	(0.474)
X_3T_t	0.717***	0.806*	0.754*	0.787	0.663***	0.710**
	(0.177)	(0.382)	(0.314)	(0.605)	(0.0399)	(0.209)
Constant	100.9***	101.0***	101.1***	100.9***	100.7***	100.9***
	(0.445)	(1.302)	(0.735)	(1.801)	(0.244)	(0.430)
Observations	60	60	60	60	60	60
R^2		0.983		0.964		0.996
Lags	1		1		1	

Standard errors in parentheses; Standard errors for OLS model are Newey-West standard errors

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Cumby-Huizinga test for Autocorrelation

H_0: variable is MA process up to order q (specified lag – 1)
H_A: serial correlation present at specified lags

lag	Chi-squared Test Statistic		
	CPI	Food	Non-food
1	30.652***	28.783***	23.866***
2	4.624*	3.898*	1.825
3	0.136	0.059	0.100

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Post-breakpoint Linear Trends of Consumer Price Index

	CPI	Food	Non-food
Post-Aug 2015	1.0330***	1.4850***	0.3950***
	(0.0124)	(0.0345)	(0.0188)
Post-Dec 2015	-0.2730	-0.3360	-0.1830***
	(0.1756)	(0.3162)	(0.0284)
Post-Apr 2016	0.4445***	0.4185***	0.4805***
	(0.0550)	(0.0805)	(0.0267)

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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AN ANALYSIS ON FOREIGN DIRECT INVESTMENT IN MYANMAR

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SUMMARY

Recent liberalisation measures including Myanmar Investment Law (MIL) in 2016 have resulted in a dramatic increase in the flow of foreign direct investment (FDI) into Myanmar between 2012 and 2016. This paper discusses the general and sector-specific benefits of FDI. The extant literature shows that FDI in the primary sector generates the least technological transfer, know-how and linkages with the market. As the flow of FDI in Myanmar has historically been dominated by the natural resource sector, there is a need to diversify the portfolio of FDI in Myanmar. The paper argues that political instability and poor infrastructure are two main constraints to optimise the flows and benefits of FDI. The paper also recommends that policy coherence and consistencies of rules and regulations across the entire government.

DEFINITION OF FOREIGN DIRECT INVESTMENT

FDI is investment made by a company or individual from one country in another country, in the form of either establishing business operations or acquiring business assets in the other country. FDI is most commonly undertaken in open economies, as opposed to tightly regulated economies. FDI frequently involves more than just financial investment, and may include provision of management or technology as well (Froot 1993, Duce and España 2003).

The two main types of FDI are inward and outward FDI. Inward FDI occurs when foreign capital is invested in local resources. The factors propelling the growth of inward FDI include perceptions of a country's 'fundamentals' and business climate, tax breaks, low interest rates and grants. Outward FDI, formally referred to "direct investment abroad", which is backed by the government against all associated risks (Duce and España 2003).

IMPACTS OF FOREIGN DIRECT INVESTMENT ON HOST COUNTRY

FDI is one of the main factors in improving trade in each and every country, while the level of investment in a country broadly is a key determinant of sustained economic growth (OECD 2002).

Of course, the great advantage of FDI is that it contributes to economic development of the particular country where the investment is being made. The major benefits of inward FDI to the economy of the host country, with direct inflows of financial capital, include technological transfer, the building of human capital, and the expansion of business opportunities for domestic enterprises via networking with multinational corporations (Kurtishi-Kastrati 2013). As a result of forward and backward linkages with foreign firms, the productivity and efficiency of local firms will also likely improve. According to theoretical models of FDI spillover through backward linkages, the intensive use of intermediate products by foreign firms increases the local variety of specialised inputs, which generates positive externalities to other final good producers and enhances production efficiency in the host economy (Rodriguez-Clare 1996).

For host countries, inward FDI has the potential for job creation and employment which is often followed by higher wages. According to Hanafy (2015), a further channel of productivity spillover is through hiring workers who were trained by foreign firms and who bring their learned knowledge, skills and technology.

The three main sectors of economy into which FDI flows are the primary, manufacturing and services, generating externalities in the form of technology transfers and managerial know-how. With regard to the formation of backward and forward linkages mar, it is found to be more relevant to investment in the manufacturing and even the services sectors, more than investment in agriculture or mining (Alfaro 2003). Among these three main sectors of economy, FDI generates externalities in the form of technology transfers and managerial know how as already noted, but access to markets tends to be more relevant with respect to investment in the manufacturing (and even the services sector) than in the agriculture or mining sectors (Alfaro 2003).

RECENT DEVELOPMENTS IN MYANMAR'S INVESTMENT POLICIES

Investment policies and laws

In 1988, Myanmar adopted a market-oriented economic system, ending 25 years of a centrally planned economic system under a socialist regime. The Foreign Investment Law (FIL) of the Union of Myanmar was enacted on 7th November 1988, under which many of the constraints to private sector cooperation, in not only domestic trade but also foreign trade, were removed. This FIL was vital for the development of the Myanmar economy. The major purposes of this initial series of Myanmar economic reforms included the following: i) to implement a market-oriented system, ii) to encourage entrepreneurial activities and private

investment in the domestic market, and iii) to open the economy to promote export and foreign direct investment.

During the initial stage of Myanmar's democratisation, the Union of Myanmar Government announced a new FIL in 2011. This new law was enacted on 2nd November 2012, and approved by President U Thein Sein. The key changes to the FIL included a wider range of permitted forms of investment, greater flexibility on the structuring of joint ventures, enhanced tax and investment incentives, and an enhanced legal framework for land use, employment, foreign currency and resolution of investment disputes.

During the current government's time, the Myanmar Investment Law (MIL) 2016 came into effect on 18th October 2016, which consolidates and replaces the previous FIL (as well as the domestic Citizens Investment Law 2013). The MIL, which provides the overall legal framework, was followed (and implemented) by the more detailed Myanmar Investment Rules 2017 ("Rules") which came into effect on 30th March 2017 as well as two notifications: Notification 13/2017 dated 1st April 2017 on Classification of Promoted Sector ("Notification 13") and Notification 15/2017 dated 10th April 2017 on List of Restricted Investment Activities ("Notification 15"). All in all, these represent the body of the current Myanmar foreign investment laws (Yuwadee-Thean-ngarm, Nwe-Oo et al.).

The new MIL is designed to stimulate and streamline domestic and foreign investment, increase investor protections, and ultimately create jobs and help diversify an economy heavily concentrated in agriculture and extractive industries. The implementation of the law, along with continuing macroeconomic reforms, will spur significant FDI growth and job creation as with business opportunities and increased investor confidence (World Bank 2017).

Compared to the FIL (2011), the MIL (2016) creates a different tax structure. The MIL (2016) does not provide tax incentives to all investors. However, it does provide income tax reduction of three, five or seven years to investors based on investment in different regions distinguished by their level of development. However, the interaction between the use of tax incentives to promote investment on a regional basis, and the specification of promoted sectors is not clarified in the law itself. A very important liberalisation step is that foreign firms can now lease land for 50 years, with two renewals for ten years each, rather than requiring annual rental permits from the Directorate of Investment and Company Administration (DICA) (Gelb, Calabrese et al. 2017).

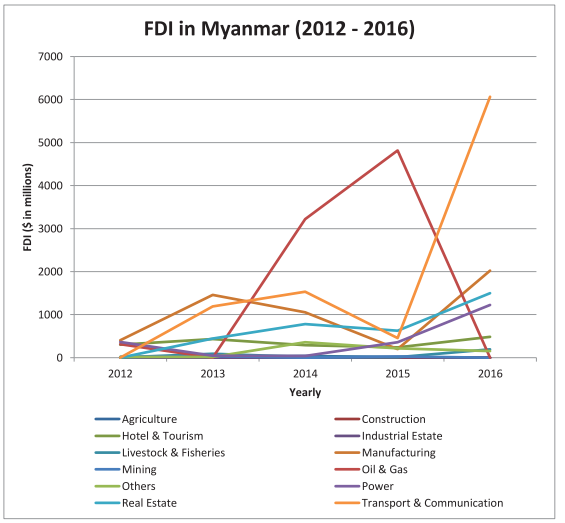
Inconsistency and challenges

Each line ministry and departments have specific incentives and parochial interests and thus there are some inconsistencies, if not incompatibility, among their policies, laws, rules and regulations across the government. For example, the MIC seeks to promote investment by providing tax incentives, while the Internal Revenue Department wants to improve revenue by imposing higher income tax. There should, therefore, be an independent legislative body to review the rules, regulations and practices of all ministries to ensure that policy coherence and consistencies of legal structures governing foreign investment in Myanmar.

ANALYSIS OF FOREIGN DIRECT INVESTMENT IN MYANMAR (2012 - 2016)

The following figure shows the trend of sector-wise FDI flows into Myanmar from 2012 to 2016.

Figure 1: FDI in Myanmar (2012 – 2016)



Source: DICA

It was found that the pattern of FDI across all the sectors were not much different, except for two sectors, Oil & Gas, and Transport & Communication. Starting from 2013, the Oil & Gas sector grew dramatically because of the new investment law enacted on 2nd November 2012. The FDI in Oil & Gas sector peaked in 2015, when it took 69% of total FDI in Myanmar. As noted above, Myanmar mainly relies on natural resources and most FDI in Myanmar has been in the natural resources

sectors. According to Alfaro and Hanafy, among all the three main sectors of FDI flows, the flow of FDI in the primary sector generates the least technology transfer, managerial know how, and access to market linkages. It can, indeed, even generate negative impacts on economic growth. The government, therefore, should try to attract FDI in manufacturing sector rather than the primary sector. There was not much fluctuation of FDI in the manufacturing sector, which experienced steady growth during the period from 2012 to 2016.

With respect to the Transport & Communication sector, FDI grew steadily between 2012 and 2015. However, in 2016 it experienced very rapid growth, and rose to about 52 percent of all FDI in that year. Singapore was the largest investor in this sector.

Too much reliance on FDI in the natural resource sector cannot contribute to the sustainable development of the Myanmar economy, and thus Myanmar urgently needs to diversify its FDI to other productive sectors. To this end, in June 2017 the MIC announced 10 areas which will be prioritised for investment by both local and foreign entrepreneurs. The 10 prioritized areas for investment include agriculture, livestock and fishery, export promotion, import substitution, power, logistics, education, health care, affordable housing construction and establishment of industrial estate.

LIMITATIONS OF COLLECTING FDI DATA

There are several challenges to analysing FDI data published by DICA. It should be noted that FDI data from DICA includes investment approved by the MIC, of which DICA is the secretariat. There is, however, an unknown amount of other formal FDI in Myanmar which has been approved by other government ministries and public agencies by state officials. In addition, many foreign investors may enter informally as shadow partners of local businesses to avoid identification as foreign, from tax or other authorities, or by customers or local communities. There is, in short, much unrecorded investment, especially in natural resource related sectors such as extractives, agriculture and forestry (Gelb, Calabrese et al. 2017).

Turning to the data published by DICA, FDI flows are presented in two categories: the 'approved' amount by 'permitted' enterprises, and the 'approved' amount of 'existing' enterprises. The latter refers to approved investment which has subsequently been realized, in the sense of actually entering country (but not necessarily in the same year as it was approved). In Myanmar, there is a gap between the two measures (as is the case in many developing countries) and the gap is very large in some years – a source accordingly of considerable confusion about FDI data in Myanmar.

SUMMARY OF FINDINGS AND SUGGESTIONS

To sum up, a body of literature shows that the effect of FDI on economic growth is conditional on prerequisite local characteristics such as human capital (Borensztein, De Gregorio et al. 1998), the level of development (Blomstrom, Lipsey et al. 1992), trade openness (Balasubramanyam 1996) and local financial markets (Alfaro 2003).

The new Myanmar Investment Law moves well beyond the 2012 FIL in strengthening investment protection standards, aiming to meet internationally acceptable levels for national treatment – foreign investors are entitled to identical treatment as domestic investors and foreign investors from all home countries will be treated identically. This also ensures fair and equitable treatment, leaving out the possibility for arbitrary adjustment of an investment's circumstances after entry, expropriation (only with good cause and with appropriate compensation) and dispute settlement mechanisms (Gelb, Calabrese et al. 2017).

Learning from the experience of other countries in the East Asian region, Myanmar can benefit from adopting technology from abroad, absorbed in the form of inward foreign direct investment. This leapfrogging could possibly endow Myanmar with unparalleled advantage and thrust its growth into an industrialised country. FDI indeed is the main contributor for transforming developing countries into industrialised ones.

There are, however, two main constraints on FDI opportunities in Myanmar: political instability, and poor infrastructure. Moreover, institutional service link costs are also high in Myanmar. In addition, foreign firms have to pay higher prices for utilities including electricity. Transportation fees to ship cargo to and from Yangon are higher than in other major cities in neighbouring countries. High labour turnover is also a challenge for the foreign investor in Myanmar. Finally, high labour turnover can be an obstacle for workers who want to gain knowledge and acquire skills (Kudo 2010).

In Myanmar, even though FDI in the services sector has increased, FDI in the agriculture sector is still very low and land acquisition issues need to be solved urgently. Myanmar, therefore, still needs to develop the above requirements and solve the aforementioned constraints to attract more FDI inflows, especially inward FDI into the manufacturing and services sectors.

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FISCAL POLICY MANAGEMENT IN MYANMAR

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SUMMARY

The 12-point economic policy of the current administration highlights the significant role of public financial management. Starting from Fiscal Year 2015-16, the Government introduced a Medium-Term Fiscal Framework (MTFF) to improve budget formulation process year-by-year in accordance with international standards and to support macroeconomic stability of the nation. Under the same umbrella of PFM reform, treasury function has also been strengthened and tax base broadened.

This briefing paper explicates Myanmar's ongoing Public Financial Management system reform and fiscal policy management. It also attempts to propose a set of appropriate policy solutions to address problems such as the declining contribution of State Economic Enterprises. The recommendations put forward in this paper range from conducting a comprehensive framework for fiscal oversight of SEEs to reviewing and rationalising tax exemptions, enhancing public education programme for budget processes and supporting the utilisation of information and communication technology for PFM reform agenda.

PUBLIC FINANCIAL MANAGEMENT IN MYANMAR

Call for reform

The 12-point economic policies of the current administration highlights the significant role of public financial management. Indeed, the first point of the policy framework is "to expand our financial resources through transparent and effective public financial management". In addition, two other points are also associated with fiscal policy management of Myanmar, such as "achieving financial stability through a finance system that can support the sustainable long-term development of households, farmers and businesses" and "establishing a fair and efficient tax system to increase government revenues and protecting individual rights and property rights through enacting laws and regulations".

Under its reform programme, the government aims to achieve deeper policy-based budgeting reforms, which encompasses performance dimensions to the Medium-Term Fiscal Framework (MTFF); reassessment of the civil service pay

and compensation, and human resource development; review of State Economic Enterprises (SEEs) performance; development of more comprehensive ways to integrate Plan and Budget (current and capital budgeting process); improvements in fiscal transparency and access to information.

All of these are implicit (and explicit) in the 12-point policy programme, but their importance has been highlighted otherwise too, including for instance, the budget speech of the Minister of Planning and Finance to the Parliament, the publishing of Citizens Budget starting from 2015-2016 FY, and the publishing of the Extractive Industries Transparency Initiative (EITI) First Report.

Budgetary reform

Public Financial Management Reform Strategy (2013) has been updated to be in line with the economic policy priorities of the new government and implementing activities. Starting from Fiscal Year 2015-16, the government introduced a Medium-Term Fiscal Framework (MTFF) to improve budget formulation process year by year in accordance with international standards and to support macroeconomic stability of the nation. Moreover, some of the key improvements have been made in the areas of:

- Fiscal decentralisation by providing subsidies and fiscal transfers to the States/Regions, with the practices of MTFF in line with six economic indicators:
    1. Total Population
    2. Poverty Index
    3. Per Capita GDP
    4. Area
    5. Urban population as per cent of total state population
    6. Per capita tax collection, and tax sharing to the regional governments:
        (a) 2 per cent of stamp duty
        (b) 5 per cent of individual income tax
        (c) 15 per cent of commercial tax
        (d) 15 per cent of specific goods tax
- Fiscal transparency by publishing the Citizens Budget beginning from Fiscal Year 2015-2016, and the first Myanmar Extractive Industries Transparency Initiative (MEITI) report in 2016.
- Preparing to legislate a new Public Financial Management (PFM) Act and issuing the updated Financial Rules and Regulation to implement it.

Under the umbrella of PFM reform, one of the major reforms was to strengthen treasury function. As a significant institutional reform, a new Treasury Department was established in September 2014 to perform cash and debt management and execute budget and financial reporting functions. The Department was established to convey a comprehensive Deficit Financing System through reducing the monetisation of deficit, gradually liberalising interest rates on bonds and bills, and securing external concessional/grant financing in collaboration with the Central Bank of Myanmar and other concerned stakeholders.

Remarkably, the Department carried out the following functions in a short period of time**:**

- Regarding cash management, the Department commenced different tasks such as weekly fund settlements between Central Bank of Myanmar (CBM) and Myanma Economic Bank (MEB), the development of the core banking system in MEB, and cash forecasting to deliver more accurate financial decisions.

- In the arena of developing a comprehensive Public Debt Management System, a series of notable changes have taken place. The Public Debt Management Law has been enacted in January 2016 and Medium-Term Debt Management Strategy (MTDS) for next five years (FY 2017-2018 to 2019-2020) has been issued. The Department transformed its manual system to Spreadsheet/Database/computerised system for recording and reporting of information on debt by introducing Common Wealth Secretariat Debt Recording and Management Software (CS – DRMS).

- Concerning Government Procurement System Reform, the Department contributed to the Procurement Rules and Regulations Supervision Committee (PRRSC). The drafted Procurement Law is expected to be enacted in 2018 and the President's Office has already issued a comprehensive Procurement Directives, the Tender Procedure for Procurement of Civil Works, Goods, Services, Rental and Sale of Public Properties for all government agencies in April 2017.

Last but not the least, the Government is attempting to start a reform programme of the Civil Service Pension System. It will transform from the current unfunded Defined Benefit (DB) pension system to the funded Defined Contribution (DC) pension system in order to lessen the fiscal burden of the Union Government.

Tax reform

With one of the lowest tax-to-GDP ratios in the region, Myanmar's Internal Revenue Department (IRD) is trying to maximise domestic revenue through broadening the tax base. In collaboration with international development partners, the Department has initiated its reform agenda beginning in 2012.

In order to modernise the current tax administration, the IRD aims to transform the Official Assessment System (OAS) to a Self-Assessment System (SAS) and as part of that effort, established the Large Taxpayers Office (LTO) in April 2014. The LTO has since conducted several programmes to check taxpayer compliance with existing laws. As a result, 95 per cent of large taxpayers submitted their annual returns on time in Fiscal Year 2015-2016.

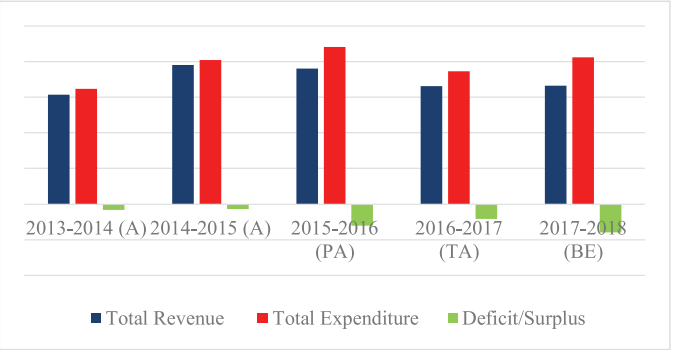
In addition, the Department has expanded the reforms by establishing a new Medium Taxpayers Offices (MTOs), and Small Taxpayers Office (STOs). At the same time, the IRD has also successfully accomplished a complete restructuring of its headquarters to be a function-based modern organisation and set up the Procurement Integrated Tax Administration System (ITAS) software.

In 2016, a Specific Goods Tax (SGT) Law was imposed for excisable commodities counted in place of the previous commercial tax law. A comprehensive tax administration procedure law (TAPL) has also been drafted.

PERFORMANCE OF FISCAL MANAGEMENT IN MYANMAR

Even though the economy slowed down to 5.7 per cent of GDP growth in FY 2016-2017, the Government of Myanmar expects to achieve the growth rate of seven per cent in FY 2017-2018. At the same time, the World Bank estimated Myanmar's economic growth rate at seven per cent and the IMF at 7.5 per cent and the ADB at 8.3 per cent, respectively. Figure 2.1 exhibits summary of Union budget data from FY 2013-2014 to FY 2017-2018.

Figure 1. Summary of Union Budget Data (FY 2013-2014 to FY 2017-2018)



Source: Budget Department, various reports of Joint Public Accounts Committee

At a glance, the budget deficit-to-GDP ratio has been maintained at around 4.37 per cent in this current fiscal year, below the five per cent threshold suggested by the International Monetary Fund (IMF). The current administration reduced back the deficit for FY 2016-2017 from an expected 4.95 per cent to 2.54 per cent through cuts to recurrent spending.

DEFICIT FINANCING

The sale of debt instruments, selling bonds and bills to finance the deficit, has been the policy of Myanmar's last two governments, which began selling bills and offering bonds to private banks and the public to reduce the reliance on quantitative easing of the Central Bank of Myanmar (CBM).

The current government has extended this, seeking to lock-in a sequenced reduction in CBM financing: 40 per cent in FY 2016/2017, 30 per cent in FY 2017/2018, 2 per cent % in FY 2018/2019 and 0 per cent subsequently.

Table 1. Sources of Financing for Budget Deficit (FY 2012-13 to 2016-17)

Fiscal Year	Treasury bill auction	Treasury bond auction	Treasury bill (CBM)	Total (Kyats Billion)
2014-2015	107.836	96.926	268.487	473.249
2015-2016	556.922	-285.745	2965.904	3237.081
2016-2017	927	927	1237	3091

Source: Budget Department

The following table demonstrates Debt to GDP ratio, Domestic and External Debt from FY 2011-2012 to FY 2016-2017.

Table 2. Domestic and External Debt (FY 2011-2012 to FY 2016-2017)

Fiscal Year	Domestic Debt		External Debt		Debt to GDP ratio
		% of GDP		% of GDP	
2013-2014	12014	20.30%	9561	16.10%	36.40%
2014-2015	12487	18.90%	9545	14.40%	33.30%
2015-2016	15724	21.40%	12246	16.70%	38.10%
2016-2017	18020	22.20%	10841	13.40%	35.60%

Source: Treasury Department

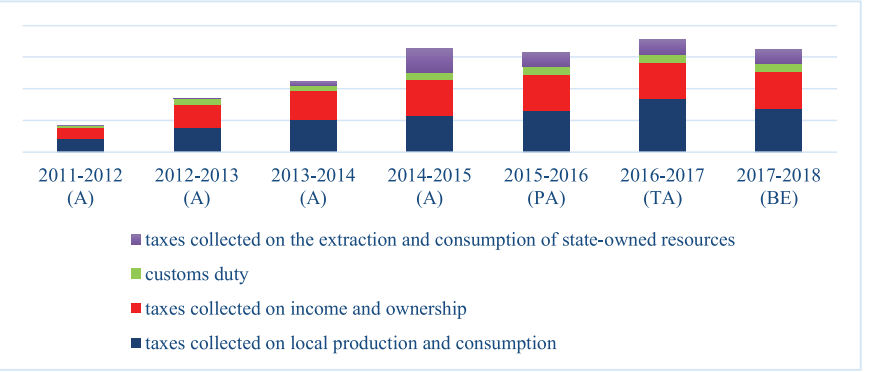
The Government has set the target of debt-to-GDP ratio of not more than 40 per cent and in line with its Medium-Term Debt Management Strategy (MTDS).

REVENUE MOBILISATION

Along with continuous efforts being made to collect more revenue for the nation from FY 2012-2013 onwards, the tax-to-GDP ratio has increased dramatically, ranging from 3.64 per cent of GDP in FY 2011-2012 to 8.78 per cent of GDP in FY 2016-2017. The Government aims to reach an anticipated 10 per cent of tax-to-GDP ratio in coming years, while the global average for low-income countries (LICs) is 15.5 per cent of GDP.

Shown in Figure 2 are the main sources of income from taxes collected on local production and consumption (including commercial tax, stamp duties, specific goods tax and fees for imports and motor vehicle registration, etc.) and taxes on income and ownership.

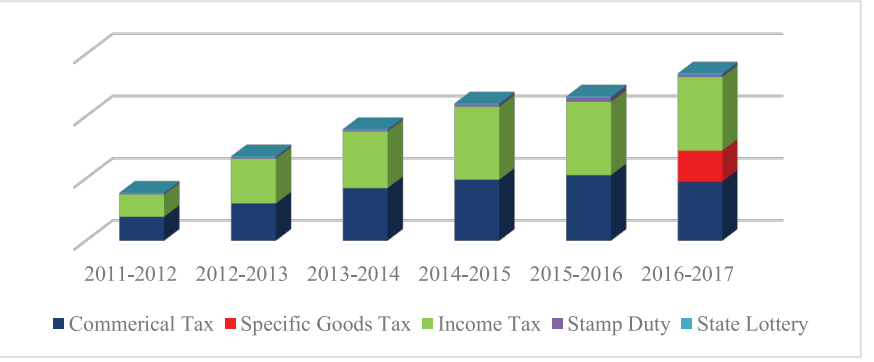
Figure 2. Main Sources of Income from Taxes



Source: Citizens Budget, various reports of Joint Public Accounts Committee

The total of IRD's overall tax collection has enormously improved since 2011, as shown in Table 3.

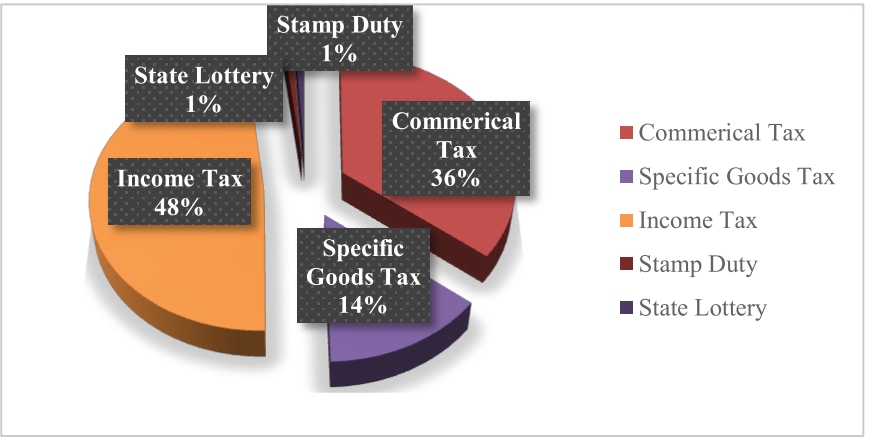
Table 3. Five Kinds of Taxes collected by IRD



Source: Internal Revenue Department

As mentioned above, income tax is the largest source of tax revenue, followed by commercial tax and certain specific goods taxes.

Figure 4. IRD's Projected Tax Collection for FY 2017-2018



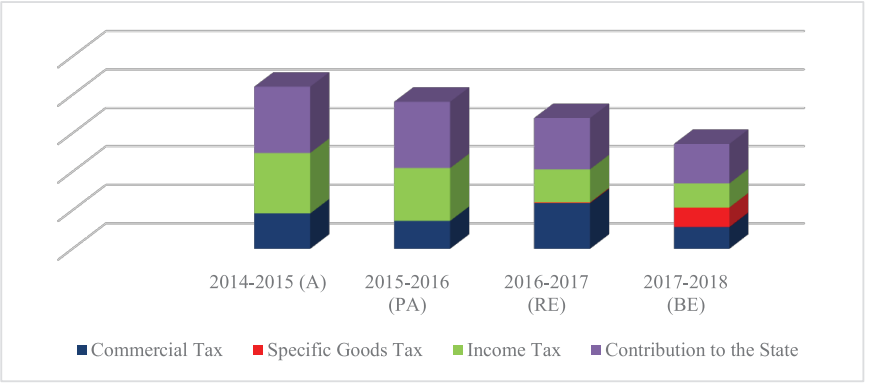
Source: Citizens Budget (FY 2017-2018)

While the amount of revenue collected from stamp duty has decreased due to varying tax rates, the collection of state lottery amounted to 40.203 billion kyats and 0.75 per cent of total collection. In FY 2017-2018, the paper-based state lottery is projected to contribute 1 per cent of total collection.

DECLINING CONTRIBUTION OF STATE ECONOMIC ENTERPRISES (SEES)

State Economic Enterprises (SEEs) have been essential in the history of Myanmar public sector as well as a significant source of revenue. However, today, the importance of SEEs in the economy has declined, as illustrated in Figure 5.

Figure 5. Contribution of SEEs to Myanmar's Economy



Source: Citizens Budget (FY 2017-2018)

KEY FINDINGS

- The capacity of bureaucratic mechanism needs to be strengthened, and there remains a need for systemic reform within some SEEs to improve their performance and financial reporting mechanisms.
- While the current deficit financing strategy is on right track, it needs to be supported by a greater focus on capital market developments.
- Notwithstanding the growth of tax revenue, there are many significant issues involving revenue leakage and tax evasion. For instance, the government is granting a series of tax incentives scheme under the Myanmar Investment Law without conducting any proper analyses.
- Public participation remains limited, even though the Citizens Budget, EITI and other parliamentary disclosures are apparent.

POLICY RECOMMENDATIONS

Based on the key findings as described above, this paper proposes a set of appropriate recommendations as follows:

- Conducting a comprehensive framework for fiscal oversight of SEEs
- Reviewing and rationalising tax exemptions by conducting tax expenditure analyses to mobilise more revenues
- Enhancing public education programmes for budget processes.
- Supporting the utilisation of information and communication technology (ICT) for PFM and its associated reform agenda.

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THE ROLE OF ON-THE-JOB TRAINING FOR EFFECTIVE EMPLOYEE DEVELOPMENT IN MYANMAR

Phyo Nge Thinn Lwin
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SUMMARY

The mission of TVET in Myanmar is to align the nation's goals towards the development of nation-building knowledge and the training of technicians, skilled workers and proficient individuals with practical knowledge. Important part in vocational sector is the on-job training given by the firms for specific purpose to provide workers with firm-specific skills, that is, skills that will increase his or her productivity only with the current employer. The experience of the selected countries shows that the TVET system has an enormous attractiveness, if it could provide the TVET graduates a high potential of job opportunities and high salaries. Moreover, providing incentive like offering job before the graduation of the vocational high schools, and government's financial subsidy on the on-the-job training cost of the companies, encouraged the employers to offer on-the-job training to their employees. The present paper suggests the need for schools and institutes to cooperate with the enterprises or firms to develop the curriculum matching for training assessment. In addition, the schools and institutes should cooperate with the enterprises or firms and to establish a funding association for the on-the-job training programs.

TECHNICAL AND VOCATIONAL EDUCATION (TVET) SECTOR IN MYANMAR

Vocational education and on-the-job training

The primary focus of vocational education is to contribute to a worker's general human capital productivity, while on-the-job training will provide workers with the skills, knowledge and competencies that are necessary for them to perform a specific job within the workplace and work environment. Employees learn in an environment in which they will need to practice the knowledge and skills taught in the on-the-job training.

There are two types of training: general and specific. General training tends to raise a worker's productivity equally at all firms whilst specific training has no effect on the productivity of trainees that would be useful in other firms. For example, if a worker learns how to use a printing machine, this will only be helpful

as long as he or she remains in the printing industry. On the other hand, if a worker has learned how to use a variety of machines and is working in only one specific machinery industry, their other skills will be superfluous to that industry.

According to the eminent (and Nobel Prize-winning) US economist, Gary Becker (1930-2014), specific human capital usually arises when workers acquire knowledge directly tied to their firms, such as how to use proprietary software and other non-transferable trainings. On the other hand, general human capital such as English-speaking skills and computer basics is often acquired by the workers at their own expenses in order to support their capability with any working situations.

TVET in Myanmar

In Myanmar, where labour-intensive and export-oriented manufacturing sectors are playing a big role in developing Myanmar's economy, such as the garments sector, telecommunications and tourism, vocational skills are recognised as highly essential.

Indeed, in Myanmar, Technical and Vocational Education and Training (TVET) is part of the 12-point economic policies of the Government and is one of the top policy priorities for the development of a skilled labour force. Since TVET is readily accessible to everyone regardless of previous education, it is very helpful to reduce underemployment and insufficient labour supply as a consequence of lack of skills.

The TVET system in Myanmar is currently regulated by the Ministry of Education, which administers it via the Employment and Skills Development Law, promulgated in August 2013. According to the TVET Draft Law (2015), the mission of TVET in Myanmar is to align the nation's goals towards the development of nation-building knowledge and the training of technicians, skilled workers and proficient individuals with practical knowledge.

The Government is currently planning to enact a specific law for TVET to govern and regulate all TVET-related activities in the country. At the same time, the National Skills Standards Authority (NSSA) is in the process of establishing a skill recognition system of workers within the country, and has already established 173 skills standards.

Table 1: Department of Technical and Vocational Education

34 government technical high schools (GTHS) throughout the country	27 technological universities (TUs) throughout Myanmar except Chin State Duration of study: five years	Three government technical colleges (GTCs) in the central dry zone Duration of Study: five years	11 government technical institutes (GTIs) mainly located at central dry zone and states in upper Myanmar. Duration of Study: two years

Source: Ministry of Education (Science and Technology)

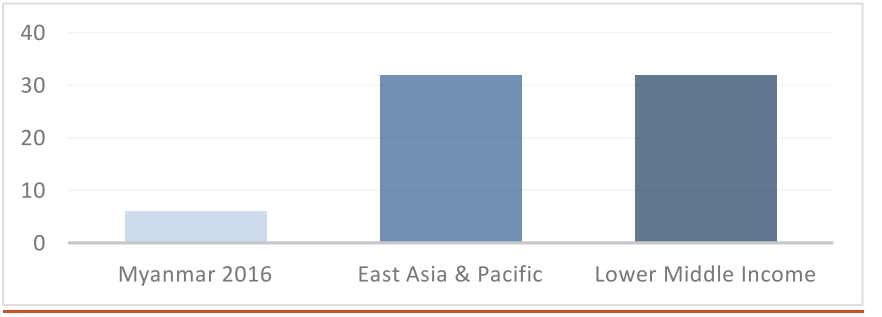
The GTHSs, universities, institutes and colleges mentioned in the above table provide both general and specific training according to the interests of the students. In the case of GTHSs, every one of those schools provides common fields of study such as Building Technology, Machining Technology, Electrical Technology, Electronics Technology, Auto Mechanics Technology, Refrigeration and Air Conditioning Technology and Information Technology.

Challenges facing the TVET sector in Myanmar

In an economy that relies heavily on labour-intensive and export-oriented manufacturing sectors such as Myanmar, there is tremendous need for skilled labour demand. However, reality shows vocational education is not popular among parents, and the percentage of youths with vocational certificates is very low, a fact backed up by the ILO's report on Myanmar School to Work Transition Survey (2015). This may be partly due to the lack of a guarantee on employability after graduating, and also the traditional thinking that general education can lead to 'better' professions.

In Myanmar enterprises, firms and industries, the practice of providing formal on-the-job trainings is not that popular, and most employees can only learn from each other while working. The major cause of low popularity in on-the-job training is the expensive cost of trainings which are borne by the firms and enterprises and the process of training reduces production (Acemoglu, D. 2009 and Autor, D. 2009).

Figure 1: Percentage of Firms Offering Formal Training in Myanmar



Source: Myanmar 2016 Country Profile (World Bank)

Figure 1 shows that the formal on-job training programmes given by enterprises in Myanmar are comparatively lower than those of East Asia & Pacific countries, and lower middle-income countries broadly.

According to the Enterprises Survey for 2014 and 2016, the progress of formal training programmes given in Myanmar enterprises can be seen as follows:

Table 2: Number of Enterprises with Training Programmes

	2014	2016
Number of Enterprises	632	607
Number of Enterprises (With Formal Training)	84	57
Number of Enterprises (Without Formal Training)	539	550
Average Number of Formal Training Programmes	**1.837025**	**1.906096**

Source: Enterprise Survey 2014 and 2016 (World Bank)

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FIRST PERSON

An Interview with U Bo Bo Nge

Each issue of the Myanmar Economic Bulletin will feature an interview with one of Myanmar's leading economic thinkers and practitioners. Bridging biography, the application of economic theory to policy-making, and the complexity of economics 'as it is done', this section is especially aimed at young scholars who might reasonably ask: Just what is it that economists do?

For this first issue of MEB we could find no better example of compelling biography, coupled with a life of economic practice and policy-making, than that of the career of U Bo Bo Nge, the newly-appointed Deputy Governor of the Central Bank of Myanmar. One of Myanmar's most innovative and energetic reformers with an almost unrivalled knowledge of the country's financial sector, Bo Bo's career is surely an inspiring for one anyone thinking about how to contribute to public life. The interview took place in September, in Naypyitaw. The interviewer is Sean Turnell.

Q: U Bo Bo Nge, recently you have been appointed Deputy Governor of Myanmar's Central Bank. Can you tell us something about your role, and your responsibilities?

I am one of three Deputy Governors of the CBM, the others being U Soe Min and U Soe Thein. Each of us have different responsibilities, with mine being financial markets, foreign exchange management, and banking supervision. Currently, and in the immediate future, it is the last of these areas that is proving the most absorbing and time-consuming of my work. Myanmar's banking system is at a critical turning point in simultaneously achieving stability as well as being a channel for growth, and so the outsize attention being paid to it at the moment is perhaps not unexpected.

But although I specialise in the areas described above, it is important to stress that all three deputies (as well as the Governor of the CBM, U Kyaw Kyaw Maung) work closely together to coordinate our work. In economics and finance few things are discrete or entirely separate, so working together across our individual portfolios is very necessary. We meet together formally at least once a week, and we make no big decisions without consulting with each other.

Q: One of the objectives of this section of MEB is to give our readers some idea of the path taken by policy-makers such as yourself – for interest, and because it might well be instructive. Accordingly, can you tell us something about your background, where you went to school and university, and what influenced your early thinking in economics and finance?

I was born in Yangon, where I was lucky enough to attend State High School No.1 (the former English Methodist School). I had a fairly normal childhood. My parents were both civil servants. My father had studied science and engineering, while my mother had done a degree in commerce in what became the Institute of Economics. But neither economics nor finance figured in my life at home. My parent's careers coincided with the nationalisation of most of the economy under the 'Burmese way to socialism', so such disciplines effectively disappeared from our country for a decade or so.

After school I went to the University of Yangon, but even there economics and finance did not feature much in my life. In fact, I initially studied geology. However, before long economics loomed larger – not so much through my formal studies (although there was a little of that) but by the way I financed my University studies. Not having much money, in my third and final year (1987-88) I started selling second-hand books on the sidewalks near the University. And it was form this activity more than anything else that I first learned about prices, markets, demand, supply, costs and so on. It was a good grounding for all that would follow. Of course, I also ran into my first experience of the heavy hand of regulation here too, as municipal police tried to enforce 'no vendor' rules on people like me. Essentially, a game of 'hide and seek' is what took place. All in all, this whole experience really shaped my thinking, as did my discussions and interactions with student colleagues in and out of class.

Following my time at the University of Yangon I went into business, first as a customs clearing agent, then as an exporter myself. Clearly this experience influenced my thinking too.

I was a political prisoner in the early 1990s, and this had a most profound influence on me in every way, including intellectually. We were not allowed to have books in prison, or even to read, and to be caught with written material was cause enough for beating and/or solitary confinement. Any sort of writing material was equally banned, and possession of a pencil or a sheet of paper a punishable offence. And yet, both I and my fellow political prisoners had an all-consuming hunger for knowledge. Accordingly, overtime we developed a system where books were smuggled in to us, page by page. It took years for a full book to be received this way, but we did it. What was immensely frustrating on top of all of this though was that the prison authorities moved us around a lot – so you mostly never got to read a full book, never got to find out what happened in the end of the stories, the narratives, the non-fiction works we

so painstakingly smuggled in. From this experience, books and writing became sacred to me, and they remain so.

I also learnt a lot from my fellow political prisoners themselves. Many of them, most them indeed, were people of great learning and accomplishment. Most have since passed away, but I remain forever in their debt. From them, from prison, I learnt English as well as so many other things, but this language skill alone was to hold me in good stead for all that would follow. Moreover, it was not simply transactional or garden variety English that I picked up, but that conveyed by the great works of English literature – Milton, Shakespeare, the classics broadly. When I later re-encountered these at University in the United States I had a head start by this strange twist of fate, even over my American classmates.

Q: Let's take up that part of your story now – after you were released you went on to the United States, went to University there, undertook post-graduate studies, and ultimately ended up as a funds manager. But how did this come about, and what were your experiences?

I went to the US in 1999, assisted by a scholar I met in prison who helped me get a job there, and arranged for me to go to college. He understood my thirst for knowledge, my desire to learn. I first went to Berkshire Community College in Pittsfield, Massachusetts. Of course, I did not have much money (I arrived in the US with just $160 in my pocket), so I had to work straight away too. My job was as a dishwasher, an occupation I can proudly say kept me alive for five years. After a couple of years at Berkshire I transferred to the famous Bard College – the campus in Massachusetts though, rather than the one in New York State. I studied both Liberal Arts and Economics at Berkshire and Bard and, as I said earlier, my reading in prison served me well. We were assigned so many of the classical works of English literature (as well as economics), but I approached these with an enthusiasm and passion that I think surprised my new-found American friends.

While I was in the US I also took the opportunity to study outside university at the CFA Institute, which combines theory and practice in the world of finance and investing. It's a very flexible, relevant programme, and I would recommend that anyone interested in economics or finance to think about undertaking some courses through it.

Following these undergraduate studies, I then went on to Johns Hopkins to do a masters' degree, and within which I specialised in international economics, but with a particular emphasis on Southeast Asia. To finish off my education story; following John Hopkins, and after deciding to devote myself to researching Myanmar and its economy (but specialising in financial management), I then went on to SOAS (School of Oriental and African Studies, University of London). I came back to Myanmar in 2014.

Q: What were the ideas that really grabbed your attention from your formal studies in economics?

Economics provides a set of intellectual tools that greatly assist in decision making. It is a rigorous discipline that makes you think about the true costs and benefits of things, and of the opportunity costs of alternative uses of scarce resources. At the same time, it is all about how we can maximise the material circumstances of our lives, and accordingly the subsequent freedom to do the things that matter to us. I am of the view too that you really should study economics formally, at school and university, to really understand it. Other disciplines such as history, politics and so on you can really do on your own through reading. They are more open to the autodidact. Economics, however, requires formal instruction I think. Interaction with your peers similarly studying the subject, discussion with professors and faculty, and then lots and lots of assessable homework.

Apart from being a student at five separate universities, my opinion on the learning and teaching of economics is also informed by the fact that I was a teacher of the discipline myself for a while, at Bard (where I also taught maths to undergraduates).

Q: Let's backtrack a bit now. You have mentioned that your life in business influenced your thinking about economics and other things. What was the business you were involved in, and how did it pan out?

From 1994 to about 1999 I was involved in exporting Taro Stem (Peine Oo in Burmese, in Roman script) to Korea, where it is used in soup. The idea came to me from the time I was a customs clearing agent, and after conversations with Korean and other business people that identified beans, pulses and other agricultural commodities as providing key export opportunities for Myanmar. But it was the Taro stem that really stood out for me, as a product that had been greatly neglected as a possible export. Indeed, it was relatively unvalued in Myanmar – being regarded for the most part as a noxious weed. Yet, for Korea, this plant (which they call 'Toran') and its stem was a much sought-after ingredient for soup. Teaming up with some friends, we identified Inle Lake as the ideal growing area, and from then on (but with lots of mistakes, lots of trial and error along the way) our export business boomed.

One interesting aspect of Inle Lake as a location was that, despite the fact that it was ideal for Taro stem, growing the plant had not been done before commercially. Indeed, the plant there was regarded as one that caused itchiness, and children were urged not to touch it. Not surprisingly then, when we first suggested to farmers that they grow it, and sell it to us for export they did not really believe us, and asked we pay them up-front. Success in our venture turned everyone around, however, and now some 3-4,000 villagers around the lake produce it for export, and it is a key

part of their livelihoods. At the same time it has also significantly reduced the number of people in that area who hitherto had to migrate to work in the lumber business. I feel really proud of our role in developing this mini 'industry'.

Q: Following your studies in the US, you worked in the financial sector. What type of financial institutions did you work for, and what was your role? Did you enjoy working in these well-established financial markets?

I worked essentially for what are called there 'boutique' financial management firms, not that different from what we might call today hedge funds of various types. The customers of these were essentially high net-worth individuals, and to attract them we had to compete with much larger investment banks. Endowment funds were also key clients (especially charitable organisations and churches), whose funds to be managed ranged anywhere between about $2 million and hundreds of millions of dollars. So, for half a dozen years or so I immersed myself in US financial markets, and took a very great interest in the activities and policies of the Federal Reserve. Every day I tried to anticipate events, investing in equities, fixed income, currencies, and mostly positioning my portfolios against the trend. Of course, soon after my involvement in these markets the Global Financial crisis took place, and suddenly my world was all about TARP (the Troubled Asset Relief Program), quantitative easing, shifting yield curves, and all sorts of other anomalies that made for interesting times to say the least. In the end I think Ben Bernanke (the Chairman of the Federal Reserve) handled the crisis well, and from whom we all learnt a lot.

Q: In 2014 you returned to Myanmar. Why, and what were your intentions?

I wanted to come home, and to recreate my life here with my wife who had sacrificed so much for me. Professionally, I wanted to be involved and understand Myanmar's financial system to its deepest depths. This is why I took a job with KBZ Bank, then (and now) Myanmar's largest private commercial bank. I headed up its research department, then became head of risk management. Altogether I headed up three departments in the Bank, and along the way was involved in setting up the payment system for the Yangon Stock Exchange so that trading could commence there.

Throughout my time at KBZ I applied the knowledge I had gained in the US, but Myanmar's financial system is very idiosyncratic, so one has to adapt and be open and flexible to the many challenges that come along.

Q: So, now you have been back a few years, have played a role in Myanmar's private sector, and now have a critically important role in the country's monetary policy and financial regulation scene. What are some of your thoughts about the economy, where it's headed, what's important, what the challenges are?

Taking up the macro-economy first, I think it can be fairly said that in the 3 to 4 years before the current government came into office Myanmar's economy was driven in part by unsustainable government spending, financed by borrowing from the central bank. There were a great many state-funded projects pumping money into the economy. These gave the appearance of a certain prosperity, but it could not be sustained. As a result of this, the first year of the new government was a time of reckoning in a sense, as a reduction of discretionary government spending came into place. Necessary, but it did mean that things slowed down for a bit. I think the appropriate metaphor for 2014/15 might be that of an economy in high gear, but with an overheating engine. This engine needed to be cooled down, even as the longer-term reforms became more necessary than ever.

Of course, we must also be conscious when cutting expenditure of not going too far, and cutting into the real and sustainable components of growth.

Another dilemma in all of this is on the revenue side, and the lack in Myanmar of a taxation system capable of delivering the funds needed for critical government services. Successive past governments relied on taxing a very narrow base, rather than attempting to broaden the sources of government revenues. This has placed unfair burdens on parts of the economy, but especially with respect to those involved in exporting, importing, mining and so on.

But substantially increasing revenues via tax reform is a long term process, all of which elevates investment, and foreign direct investment (FDI), as the most plausible source of finance for short to medium term sustainable growth. Investment in Myanmar has traditionally been below that needed, and FDI too has been scarce. Accordingly, both need to be encouraged, but on this front I am pleased to say that via a number of measures, including the new Investment Law, Company Law, some changes in bank regulations and the like, this is precisely what the government has been doing.

Countervailing government expenditure against cyclical downturns is always desirable, but at the moment it has the extra virtue of providing the infrastructure Myanmar needs for longer term growth too. We can scarcely go wrong in spending more on our electricity generation and distribution systems, or the national road network, rural and secondary roads, ports, bridges, and so on. Such expenditures have big fiscal multipliers, but they also greatly add to productivity. Investing in

infrastructure is relatively safe for both public and private sector actors alike. Accordingly, the focus here should be on encouraging the private sector, on its own and in cooperation with government in public-private partnerships, rather than emphasising state-owned enterprises, and similar vehicles favoured in the past. I am a firm believer that Myanmar's private sector will be the prime engine of growth.

Fixing the banking system is important for all sorts of reasons, but including on the investment front. In the past so much bank-created assets were in wasteful areas of real estate speculation and the like. What we need to do now is not just expand the ability of our banks to create capital, but also to allocate this in more socially productive ways. Again this is an area in which the government (and central bank) is paying much attention, and to which new prudential rules designed to implement the 2016 Financial Institutions of Myanmar Law are directed. In reactivating Myanmar's banking system it is also critical to pay attention to the whole financial ecosystem – accounting, auditing, contract enforcement, judicial reforms. These and other enabling reform measures are needed just as much as direct changes to bank regulations. Interestingly, in this area is where perhaps international aid agencies and the multilateral financial institutions (World Bank, IMF, Asian Development Bank, etc) can play an important and catalytic role.

More broadly, foreign involvement in our economy is critical. The benefits of FDI in job creation, technological and methodological transfer, in connecting us to global production chains and so on, are probably obvious. Less apparent, but maybe just as important, are the openness to foreign participation in services, in banking, insurance, accounting, auditing – all the things that make up the 'soft infrastructure' that drives participation in the global economy. Donors can also be helpful in governance generally, and in giving assurances that Myanmar is a safe and reliable venue for investment.

Q: You have achieved considerable success in your career, and are now in a position to give something back. What advice would you give to readers of this interview who may be similarly minded – who would like to strive, not just for themselves, but for their country. To influence policy-making, and be drivers of events?

I think the first advice I would give is to get some private sector experience. Without this you may know about policy, but you will not know how the subjects of policy are likely to react. In other words, you will not know about implementation, and the channels through which policies work. There is a great deal of resilience as well as energy in Myanmar's private sector. Without knowing much about it your work as a policy-adviser will be like attempting to drive a car with one eye closed. So, education is important, and the theories derived from your studies is important too, but practice so often departs from theory according to circumstance. I know this

first hand when I first ventured into finance in the USA. The private sector is the place to get real hands-on experience that will be valuable to anyone really wanting to engage in the sort of policy-making that can make a difference.

Q: Any final thoughts?

This is such an important time for our country. If we don't rebuild our economy now we are in danger of effectively losing our true independence, and being flotsam on the water of forces beyond our influence or control. The collapse of the Soviet Union three decades ago revealed many things, but not least that the real power of a nation is centred upon its economy rather than how many tanks it has. Countries that recognise this, that strength comes from their enterprise and economic institutions, will be the ones that survive and prosper in the 21st century and beyond. This is our moment.

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