Policy paper

International Growth Centre

Estimating a social discount rate for Myanmar

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I Motivation

Governments are faced with a long list of potential public investment projects to choose from. The criteria for selecting projects naturally depends on the strategic goals that a government is looking to address, be they improved health outcomes, reductions in poverty, or enhanced trade. Even once a target outcome is decided, selecting between competing public projects remains challenging. To guide this decision, economists estimate a social discount rate, sometimes referred to as a hurdle rate of return, to quantify the benefits that a project brings over time. With a figure in place governments can then better assess projects based on their social returns.

Estimating social discount rates has a deep history in economics as it wrestles with fundamental questions about how welfare changes as individuals grow richer and how much present consumption should be favoured over future consumption. It is a topic subject to as much debate over methodology as over ethics, and ultimately any reported figure should be interpreted as reflecting an indicative *range* of values. Despite this, these estimates can still serve as meaningful references.

Drawing from a variety of sources, this note outlines a basic estimation of the social discount rate for Myanmar using two complementary approaches. Given Myanmar's position at a historical turning point, forecasts for long-term growth will be subject to considerable uncertainty and cannot be determined solely from previous consumption data. To address this concern, a variety of scenarios are considered. The first approach, using a social welfare function, estimates the social discount rate to be between 10–13%. To complement this estimate, an alternative methodology based on the opportunity cost of capital is used, arriving at a higher estimate of 18–21%. As a result, Myanmar should expect the returns to its projects and investments to be high, perhaps somewhere between the two estimates. These figures provide indications of what the social discount rate for Myanmar could be *today*; naturally, as Myanmar grows, the discount rate will also evolve. At the end of the note is a technical appendix which describes in greater detail the model, data, and estimating assumptions used to arrive at the results.

II Methodology

There are three core elements behind estimating a social discount rate. First, the benefits of a project depend on the economic wellbeing of recipients; the additional value of receiving an extra unit of money is larger for poorer individuals than for richer individuals. As a result, any welfare analysis of long-term projects needs to take into account how economic wellbeing (often measured by consumption) will grow over time. A second, related, element involves forming a view on how

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the extra benefits from additional units of money decline as you become richer, often known as the elasticity of the marginal utility of consumption. The final element stems from the government's unique responsibility to balance the immediate needs of its current citizens with the needs of its future citizens. Whether the welfare of future beneficiaries is less important than the welfare of contemporary beneficiaries, and if so by how much, needs to be decided. One view is that all should be treated equally, while another argues that greater importance should be placed on today's beneficiaries, especially if they are struggling with poverty.

As a result, there are several approaches to estimating social discount rates. This section briefly covers the methodology for the two approaches used in this note: (a) the maximization of a social welfare function and (b) the calculation of the opportunity cost of capital as a measure of the discount rate. Full technical details are provided in the appendix.

Theoretical approaches like these rest on deep assumptions about the efficiency of markets, let alone the existence of a benevolent planner who can allocate resources in an optimal way. Despite this, these exercises are still useful in providing us with a **reference** for what the true optimal social discount rate might be.

(a) Solving an optimal social welfare function to arrive at the social discount rate ("Ramsey rule")

Imagine there exists a social planner in the government who can allocate resources in the economy to balance consumption today with savings for consumption tomorrow. How would they strike this balance to ensure that the benefits across all individuals and across time are maximized?

The basic problem, which is laid out in full in the appendix, revolves around choosing consumption today (c_t) and (implicitly) net investment ($\dot{k}_t$) for tomorrow in order to maximize the total benefits to society (measured by utility, u). These choices are influenced by the degree to which we offset future consumption (time discount, δ) and by how much we benefit from additional consumption (elasticity of marginal utility, γ). The solution to this problem is the famous Ramsey rule which states that the social discount rate (SDR_t)[1] is given by:

$$SDR_t = \delta + \gamma \left(\frac{\dot{c}_t}{c_t} \right) = \delta + \gamma g_t$$

where g_t is the growth rate of consumption.

With this result in place, the next step is turn to the data to find the best estimates for the three unknowns in our equation: the growth rate of consumption (g_t), how much we discount the future relative to the present (δ), and how the additional utility from an increase in consumption changes (γ). For g_t, we use historical data on long-run consumption growth in Myanmar as well as in neighbouring countries to arrive at reasonable scenarios. National income accounts data can be used to look at consumption growth but we focus instead on survey data on household expenditures. For δ, we can use crude death rates as a measure of how much we should balance today's vs. tomorrow's consumption. For γ, data difficulties mean we resort to using estimates from India taken at reasonably similar levels of development as Myanmar today.

(b) Calculating the opportunity cost of capital to measure the social discount rate

Public investments are financed by public debt and by taking funds out of the economy through taxation. Because resources are scarce it then becomes essential that the returns from government

[1] Here the social discount rate is defined as the level at which the marginal rate of substitution is equal to the marginal rate of transformation. Alternative definitions exist.

investments at least match, if not exceed, the returns from private sector investments. If this is not the case then it would be optimal to leave the funds in the private sector where a higher return can be achieved. In short, there is an opportunity cost associated with government investment decisions.

Economists look at the weighted average cost of capital to calculate the minimum rate of return necessary for private sector investments to go ahead. We can use this figure as a reference for what private sector returns from different investment projects are. If the returns on public investment projects fall far below this level then it may no longer be optimal for the government to proceed.

Calculating the weighted average cost of capital rests on measuring the cost of equity (C_e) and debt (C_d) financing. Overall project costs are influenced by the degree of leverage (proportion of debt in the total capital structure, λ) and by the corporate income tax rate (τ). The cost of equity is determined by the yield spread ($r_m - r_f$), project risk (equity beta, β_e), and country risk (θ). The cost of debt is determined by the risk-free rate (r_f), intermediation spread (α), and country risk (θ). Both can be adjusted for inflation, corporate tax rates, and other transaction costs.

As Myanmar does not have a mature capital market, using in-country data to arrive at estimates for the above parameters is very difficult. Similarly, just as our approach on maximizing a social welfare function rested on strong theoretical assumptions, calculating the weighted average cost of capital also relies on strong requirements for market efficiency. Nevertheless, this serves as an approximate estimate for what the real cost of capital may be for a private sector company in Myanmar.

To fill the gaps in data, a combination of local data on known parameters (e.g. corporate tax rates, inflation, debt-to-equity ratios) and international estimates (e.g. country risk premia, sector betas, risk-free rates) are used to arrive at estimates.

III Estimates of the social discount rate for Myanmar

Using the social welfare function

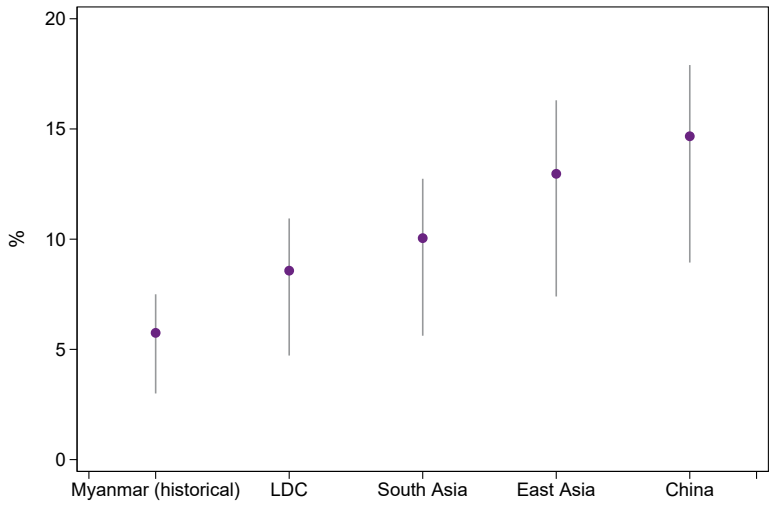

Figure 1: Estimates of the social discount rate based on different scenarios

Figure 1 presents a range of estimates for the social discount rate. The estimates vary across different scenarios for consumption growth, each reflecting the long-run average historical rate of

consumption expenditure growth among different sets of countries. These scenarios can be used to explore how the discount rate changes based on how strong we think future consumption growth in Myanmar will be. The error bars (| above) for each estimate reflect the minimum and maximum values the discount rate might take based on the levels we choose for the elasticity of the marginal utility of consumption and for the time discount rate. The point estimates (●) reflect the closest estimates for Myanmar under each scenario. **Table 1** presents the headline figures in detail, with figures in **bold** reflecting best estimates.

		Consumption growth scenario						
		Historical	LDC	South Asia	East Asia	China		
	Min	3.00	4.72	5.62	7.40	8.94	Min	
Elasticity	Mid	**5.75**	**8.57**	**10.05**	**12.97**	**14.67**	Mid	**Time discount**
	Max	7.50	10.94	12.74	16.30	17.90	Max	

Table 1: Social discount rate (%) based on different consumption scenarios, elasticity values, and time discounts. See appendix for parameter values.

What consumption growth scenario should Myanmar expect to follow? **Figure 2** shows the moving 10-year average consumption growth rate for a variety of regions and for individual countries. The first scenario (**Myanmar (historical)**), reflecting average consumption growth rates in broadly the last decade and a half, should be interpreted as the lower bound: given the promising opportunities for economic growth on the horizon, we should expect growth to increase at a faster rate. The real consideration then turns to deciding by how much consumption growth rates might increase. Among least developed countries (LDCs), the historical average is 4.72%, while for East Asia & Pacific (minus high income) it is 7.40%. Some of Myanmar's neighbours, such as Cambodia or Laos, have seen similar average rates of consumption growth, albeit with considerable variation.

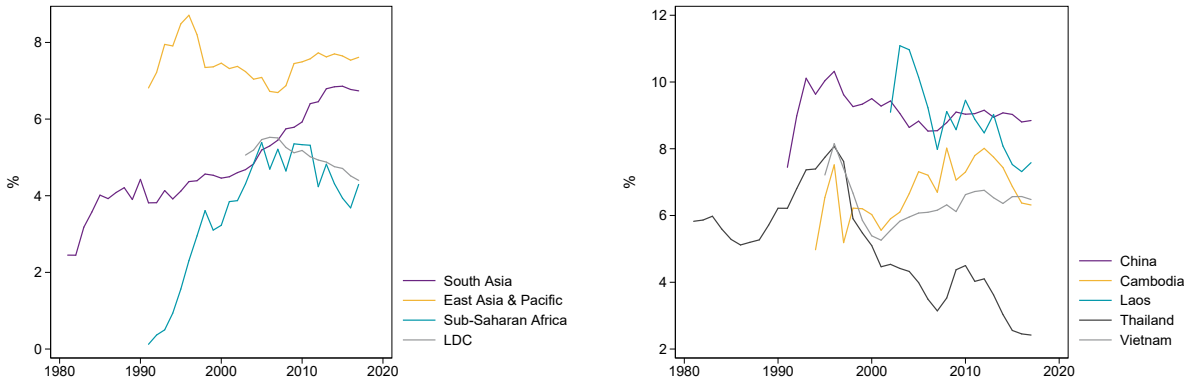

Figure 2: 10-year moving average of household consumption expenditure growth

Therefore, a long-run target average rate of growth should be to meet historical South Asian averages[2] (≈6%), with a more aspirational goal being to track the growth experience of some of East Asia's successful economies (≈7.5%). **This would place the social discount rate in the**

[2]We arrive at a similar figure if we use projected GDP growth for Myanmar (as set out by the IMF) and then adjust this based on the correlation between GDP growth and household expenditure growth using a basket of South Asian countries ($\rho = 0.85$).

range of 10–13%, a figure similar to that used by the World Bank (10%) and ADB (12%). The most ambitious scenario for consumption growth would be for Myanmar to follow in the footsteps of the Chinese growth experience; this would set the discount rate in the range of 14–15%.

Using the opportunity cost of capital

Figure 3 presents estimates of the weighted average cost of capital across different sectors and based on two different models. The 'simple' model (●) calculates the cost of capital under conditions reflecting efficient and developed capital markets. These conditions do not hold in Myanmar, and these estimates should be interpreted as lower-bound figures. An 'adjusted' model (●) which incorporates greater transaction costs and country risks into the calculation of the cost of capital are likely to be closer to the actual costs of capital for Myanmar. Error bars (| above) reflect the different values based on the data we use for the equity betas[3]; the range comes from whether we use estimates from Indian, Chinese, or an average of all emerging market firms. **Table 2** summarises the results.

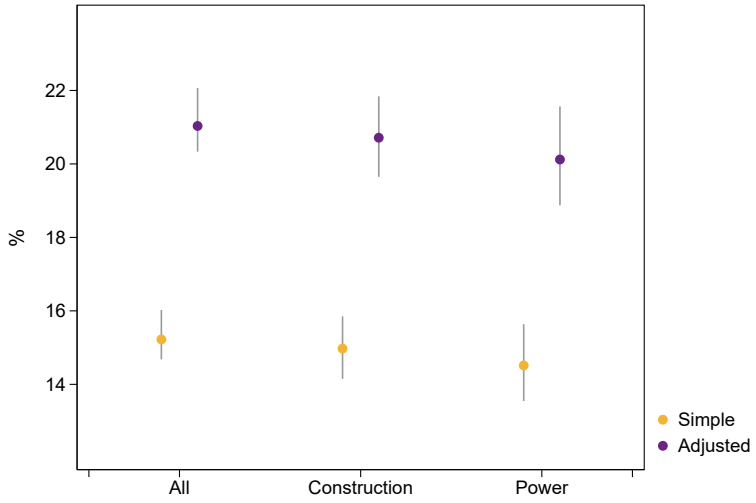

Figure 3: Estimates of the cost of capital based on different sectors & models

	Cost of capital (%)	
Sector	Simple	Adjusted
All sectors	14.7–16.0	20.3–22.1
Construction	14.1–14.9	19.6–21.8
Power	13.5–15.6	18.6–21.6

Table 2: Weighted average cost of capital estimates by sector and by model

The differences between the two models are significant. Given Myanmar's unique growth opportunity as an historically untapped market, some investors may be willing to take on more risk than normal when doing business in the country. If so, this would suggest that our adjusted model's estimates are on the high-end. The rates vary across the types of project or sector due to natural

[3]For a more detailed discussion, please refer to **Appendix V**.

differences in the level of risk associated with such investments. Nevertheless, this exercise suggests that **an indicative range for the hurdle rate of return, from a private investor's perspective, might be between 18–21%**. This is higher than rates calculated previously. A consulting firm has calculated an indicative 16% hurdle rate for power generation projects in Myanmar (in 2012), compared to 11% for Cambodia and Laos (Tamotia & Sosrodjo 2012).[4] By definition the rate of return necessary for a private investment should be higher than a public investment due to differences in the costs of equity and debt due to different levels of risk.

IV Policy implications

The government should expect high returns from its public investments. This is mostly driven by the high expected growth of consumption in the future. The key challenge to pin-pointing an exact hurdle rate of return is that Myanmar's trajectory for economic growth remains uncertain. Very high levels of growth in the near future would push up today's social discount rate higher. It is important to note that the estimation of a social discount rate is time dependent; were circumstances to change considerably – for example after several years of sustained economic growth – then the discount rate would also evolve. This analysis should be done regularly after several years of progress and once better data is available.

The high cost of capital sheds light on a wider challenge facing Myanmar: project financing is unlikely to be easy nor cheap. While there are several factors at play, the core reasons relate back to the lack of a developed and functional local capital market. The hurdles faced when doing business means that capital will not necessarily flow to those businesses who are most efficient. The dominant role of state enterprises also impacts how credit is allocated in the private sector. The country risk premium attached onto firms seeking debt financing for operations in Myanmar is also a potential area for concern. Risk premia capture a diverse set of characteristics, from economic to political to security, and are thus sensitive to shifts in investor sentiment.

Ultimately, a combination of both public and private investments will be necessary for Myanmar to reach the long-term targets it has set in the Myanmar Sustainable Development Plan (MSDP). The scale of investment requirements in sectors such as infrastructure alone means that the government needs to draw in private sector financing to succeed. Creating clear plans for coordinating public and private investments will help steer funds into the right areas. Strategic prioritization and rigorous screening of public investment projects can ensure that the government gets the most return from its investments. Lastly, continued reforms and progress in developing the environment for business will enable the private sector to invest more.

[4]Their methodology adheres very closely to the 'simple' model used in this analysis, and in that respect the estimates presented here are similar.

V (Appendix) Calculating the social discount rate using the Ramsey rule

V.I Model

One method to estimate the social discount rate is to employ the Ramsey rule, derived from the maximization of a social welfare function with various assumptions and calibrations on the nature of time preference, elasticity of consumption, growth rate of consumption, and on risk aversion.

$$\max \quad \int_0^{\infty} e^{-\delta t} u(c_t)\, d_t \quad \text{st} \quad \dot{k}_t = f(k_t) - c_t \tag{1}$$

where:

δ = the time discount rate
c_t = consumption period t
$\dot{k}_t$ = net investment in time t

Assuming constant relative risk aversion such that:

$$u(c_t) = \frac{c_t^{1-\gamma} - 1}{1 - \gamma}$$

It follows from optimization that the **social discount rate**, SDR, is defined as (Ramsey rule):

$$r_t = f'(k_t) \equiv SDR = \delta + \gamma g_t \tag{2}$$

where:

γ = elasticity of the marginal utility of consumption
$g_t = \dot{c}_t / c_t$, the growth rate of per capita consumption

If desired, one can introduce uncertainty in the rate of growth in per capita consumption over time by extending the Ramsey rule as follows:

$$r_t = \delta + \gamma \mu_g - 0.5\, \gamma^2 \sigma_g^2 \tag{3}$$

where the above assumes a normal distribution of independently and identically distributed shocks to consumption over time with mean consumption μ_g and variance σ_g^2.

V.II Estimation

Estimating a social discount rate rests on three key variables:

- How much we discount the future relative to the present (δ)
- How the additional utility from an increase in consumption changes (γ)
- How much consumption will grow over time (g_t)

For each of the three main parameters, a range of values will have to be given as we will need to consider various scenarios.

Parameter	**Estimation**
δ	Typically between 1-1.5%, though the World Bank tends to set this to zero so as to not value the consumption of individuals today more than those in the future. To inform this decision, we typically compare **mortality rates** and adjust up (down) based on whether mortality is high (low). Using a 10-year average of the crude death rate for Myanmar (WDI), this is figure is 0.83%.
γ	Typically between 1-2. Using data on India between 1965 and 1995, one estimation provides a value of 1.64, which is the best-guess value used in the scenarios for Myanmar. Calculating this from scratch in Myanmar remains challenging; one method is to calculate this from income and price elasticities, but this relies on strong data.
g_t	The standard approach is to use past per capita consumption growth rates. Given spotty historical data in Myanmar and large projected changes to future growth rates, this will not be easy. An analysis by the World Bank on recent poverty trends in Myanmar finds an annualized 2.7% consumption growth rate between 2004 and 2015, with this rate increasing to 3.0% in the last five years World Bank (2017).

Table 3: Description of parameters used for the social discount rate

Based on the above table, the following parameter values were used for the various scenarios:

Scenario	**Consumption growth (g_t)**	**Data period**	*Source*
Myanmar (historical)	3.00	2009–2015	World Bank (2017)
LDC	4.72	2003–2017	
South Asia	5.62	1992–2017	
East Asia & Pacific	7.40	1992-2017	

Parameter	**Min**	**Middle**	**Max**	*Source*
Time discount (δ)	0	0.83	1.5	WDI
Elasticity (γ)	1	1.64	2.0	Kula (2004)

Table 4: Assumed parameter values for scenarios

VI (Appendix) Calculating the hurdle rate using the weighted average cost of capital

VI.I Model

To calculate the minimum level of return on investment needed for a project to go forward it is common to look at the weighted average cost of capital (WACC):

$$\text{WACC}_1 = (1-\lambda)C_e + \lambda(1-\tau)C_d \tag{4}$$

where:

C_e = the cost of equity finance
C_d = the cost of debt finance
λ = leverage (the proportion of debt in the total capital structure)
τ = nominal corporate income tax rate

This approach recognises that private investors have a menu of potential investments to choose from and that only when the expected returns are high enough will it make financial sense to invest. Because Myanmar does not have a developed capital market this exercise will be difficult. However, using values for neighbouring and/or similar economies we can arrive at indicative figures. We will first estimate a very simple model and then amend this model to include greater risks and transaction costs. First, to estimate the cost of equity financing the simplest approach is to start with the capital asset pricing model (CAPM):

$$C_e = r_f + \beta_e(r_m - r_f) + \theta \tag{5}$$

where:

r_f = risk-free rate of return
r_m = expected stock market return
β_e = equity beta of project, measuring its systematic risk, proxied by β_l (below)
θ = country risk premium

Because leverage can influence risk, we need to disentangle β_l using its unlevered value, β_u:

$$\beta_l = \beta_u\left[1 + \lambda\left(1-\tau\right)\right] \tag{6}$$

To measure the cost of debt:

$$C_d = r_f + \alpha + \theta \tag{7}$$

where:

α = premium for corporate bond issues (intermediation spread)

The above simple model risks on very strong assumptions about the development and efficiency of the capital market. For many reasons, these conditions will not hold in Myanmar. Therefore we can amend the above model to incorporate transaction costs, taxes, and country risks into the cost of equity:

$$\hat{C}_e = \left(1-\tau\right)C_d + \beta_l(r_m - \hat{r}_f) + \hat{\theta} \tag{8}$$

where:

$\hat{\theta} \equiv \theta(1-\tau+\beta_l)$

Additionally, we can incorporate domestic inflation (π) into our calculation of what a risk-free rate of return should be:

$$\hat{C}_d = \hat{r}_f + \alpha + \theta \tag{9}$$

where:

$\hat{r}_f \equiv (1 + r_f)(1 + \pi) - 1$

This adjusted CAPM model takes into account the greater risks an investor will have to take on to operate in an emerging market like Myanmar. Therefore we can calculate an amended cost of capital:

$$\therefore \quad \text{WACC}_2 = (1 - \lambda)\hat{C}_e + \lambda(1 - \tau)\hat{C}_d \tag{10}$$

VI.II Estimation

The lack of a developed capital market means this exercise is not straightforward and any calculations will rest of several assumptions. However, this approach can provide a back-of-the-envelope calculation for a hurdle rate of return (from a private sector perspective) for investing in Myanmar. Where data gaps exist, estimates and parameter values from similar emerging markets are used.

Parameter	**Estimation**
λ	Typically debt to equity in power projects in Cambodia/Laos are between 60:40 to 70:30. The Myanmar banking sector has a ratio of 64:36, which is used for estimation.
τ	Corporate tax rate in Myanmar: 25%.
r_f	Geometric average of the interest rate on 10-year US Treasury bills (approx. 3%) , which can be adjusted by inflation differential ($\hat{r}_f$). The Central Bank of Myanmar puts the latest year-on-year inflation (π) figure at 5.42%.
$r_m - r_f$	Geometric average of the spread of 10-year US Treasury bills, adjusted for domestic inflation, and an established equity index such as the S&P500. Long-run stock market returns (1928–2017) are approx. 9.65%.
β	The values of β_u are taken from Damodaran (2018*a*) and are split based on classification (all emerging markets; India; China) and by sectors (all sectors; construction; power).
θ	NYU calculations on country default spreads and risk premiums (for Myanmar, $\theta = 7.5\%$).
α	The intermediation spread is calculated using an average of the spread on corporate bonds of B and lower rated corporations in emerging markets (5.49%) over the last six months.

To summarise, the parameter values listed below were used to calculate the weighted average cost of capital:

Parameter	**Value**	*Source*
Leverage (λ)	64%	Chassat & Foerster (2016)
Corporate tax (τ)	25%	Government of Myanmar
Risk-free rate (r_f)	3.00%	U.S. Treasury
Inflation (π)	5.42%	Central Bank of Myanmar
Stock market rate (r_m)	9.65%	Damodaran (2018*c*)
Risk premium (θ)	7.50%	Damodaran (2018*b*)
Intermediation spread (α)	5.49%	FRED

Table 5: Parameter values for WACC

The only remaining parameter to estimate are our re-levered betas (β_l). These figures range considerably across markets and across sectors. The best approximation we can use is to look at different scenarios which vary the basket of companies and which focus on different market sectors. Given

that the necessary data to calculate Myanmar-specific betas does not exist, we resort to using values based on three different sets of company figures: an average across all emerging markets; Indian firms; and Chinese firms. Three sectors are chosen: all sectors; the construction sector; and the power sector. The table below summarises the results.

Sector	**Emerging markets**	**India**	**China**
All sectors	0.91	0.99	1.29
Construction	0.76	1.24	0.98
Power	0.59	1.18	0.82

Table 6: Re-levered beta values (β_e) based on different scenarios. Unlevered betas (β_u) taken from Damodaran (2018*a*).

These different scenarios are used to construct a range of values for what a feasible cost of capital in Myanmar might be. A summary of the cost of equity (C_e), cost of debt (C_d), and cost of capital (WACC) under the two models (WACC_1 and WACC_2) is presented below. Estimates from the simple CAPM are in black while adjusted CAPM estimates are in purple.

Sector	**Emerging markets**		**India**		**China**	
Cost of equity						
All sectors	19.5	27.7	20.2	28.7	23.2	32.5
Construction	18.0	25.8	22.7	31.9	20.1	28.6
Power	16.3	23.7	22.1	31.1	18.6	26.6
Cost of debt						
Before tax		16.0			21.6	
After tax		12.0			16.2	
WACC						
All sectors	14.7	20.3	15.0	20.7	16.0	22.1
Construction	14.1	19.6	15.8	21.8	14.9	20.1
Power	13.5	18.9	15.6	21.6	14.4	18.6

Table 7: Cost of equity, debt, and capital estimates. All figures in %.

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