

A Cross-Portfolio Analysis of Roads Rehabilitation Financed by the Millennium Challenge Corporation in Developing Countries

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MCC is a small, U.S. Government agency with an innovative and tested approach to fighting global poverty. MCC forms bilateral partnerships with the world's best-governed poor countries to reduce poverty through economic growth

- Created by the United States Congress in 2004, MCC empowers the poor by investing in projects that help people lift themselves out of poverty, like electricity, clean water, land rights and roads.
- MCC's partnerships are typically large, five-year grants focused on removing constraints to economic growth and are centered on competitive selection, rigorous economic analysis, and independent evaluation of all projects.
- MCC's transportation portfolio totals \$2.9 billion in projects across 18 countries between 2005-2015.

	Yearly		Yearly		3 Months		I-2 Years		>5 Years		Post-Compact
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>	MCC partnership	_	Partner countries	S	An economic analysis	ıt	Partner countries	L	Projects agreed	_	MCC compact

Figure 1. MCC's model of country partnership begins with competitive selection for MCC compact eligibility, followed by country-led compact development and implementation, and independent evaluation of each project.

Economic returns of projects are assessed before, during, and after investment

- Throughout MCC's history, poor road infrastructure and high transportation costs have been some of the most common constraints identified in growth diagnostics.
- Each country-proposed project undergoes rigorous cost-benefit analysis (CBA) to estimate an economic

Compact Details		Project Details	Economic Rate of Return					
Cou	ıntry	Project	Completed Length (km)	Road Disbursements (Million U.S. \$)	Original	Closeout	Post- Compact Pending	
2005-2010	Cabo Verde	Roads and Bridges	40.6	27.70	13.0%	N/A		
2003-2010	Honduras	Transportation	610	118.06	24.1%	N/A	13.0%	
	Armenia	Armenia Rural Roads	24.40	8.44	25.9%	17.6%	N/A	
2006-2011	Georgia I	Roads	220.2	212.87	20.0%	15.0%	N/A	
2000-2011	Nicaragua	Transportation	67	57.88	13.2%	N/A	2.1% 10.30%	
	Vanuatu	Transportation Infrastructure	149.7	58.33	24.2%	N/A		
	El Salvador I	Connectivity	223.32	270.05	23.9%	21.6%	Pending	
		Community Infrastructure (rural roads, bridges)	223.32	270.05	10.4%	11.3%	Pending	
2007 2012	Ghana I	Trunk Roads		213.08	17.0%	0.0%	Pending	
2007-2012		Feeder Roads	446.78		18.0%	20.0%	Pending	
		N1 Highway			36.0%	33.0%	Pending	
	Mali	Alatona Irrigation Roads	81	44.77	10.3%	N/A	Pending	
	Mongolia	Roads	176.4	66.49	17.0%	9.4%	Pending	
2000 2012	Mozambique	Rehabilitation/Construction of Roads Project	253	133.81	10.3%	7.3%	Pending	
2008-2013	Tanzania	Mainland Trunk Roads	100	201 54	17.4%	N/A	Pending	
		Zanzibar Rural Roads	180 391.54		11.6%	N/A	Pending	
		Banfora-Sindou			1.0%	Pending	Pending	
		Bomborokuy - Mali Border Road			-2.5%	Pending	Pending	
		Dedougou-Nouna			2.7%	Pending	Pending	
2009-2014	Burkina Faso	Koudougou-perkoa	419	159.83	-1.6%	Pending	Pending	
		Koudougou-sabou			0.1%	Pending	Pending	
		Nouna - Bomborokuy Road			-3.3%	Pending	Pending	
		Perkoa didyr			-0.8%	Pending	Pending	
	Moldova	Moldova Road Rehabilitation		109.75	21.0%	Pending	Pending	
2010-2015		National Road #2	2=2		10.9%	Pending	Pending	
	Senegal	National Road #6	372	238.51	11.3%	Pending	Pending	
2011-2016	Philippines	Secondary National Roads Development	222	138.12	13.7%	Pending	Pending	

Figure 2. ERRs are calculated during project planning (original), at project completion (closeout) and after completion as part of project evaluations (post-compact). Estimated ERRs have tended to decrease between planning and completion of roads rehabilitation projects. though most remain above MCC's 10% hurdle rate for investment.

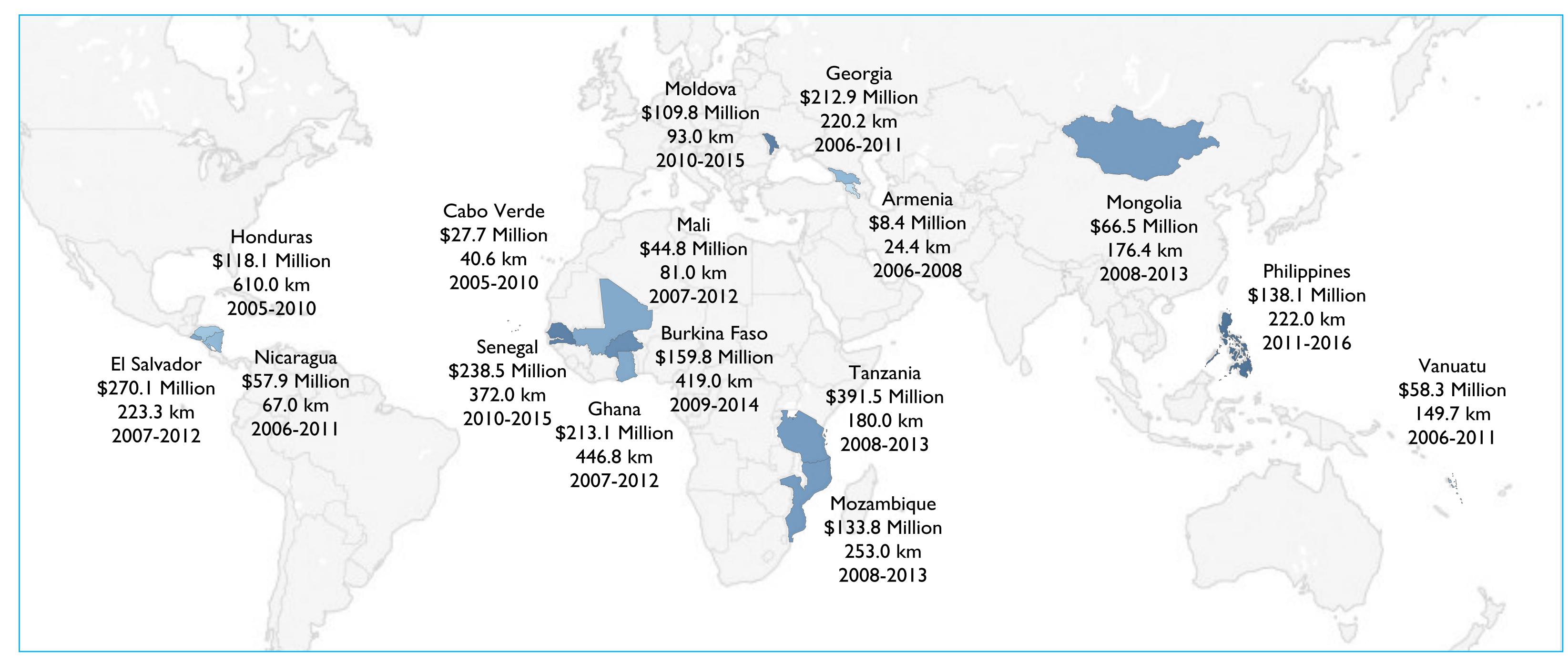


Figure 3. Map of MCC partnerships featuring roads rehabilitations, including amounts disbursed, total length of roads built, and years of each compact investment.

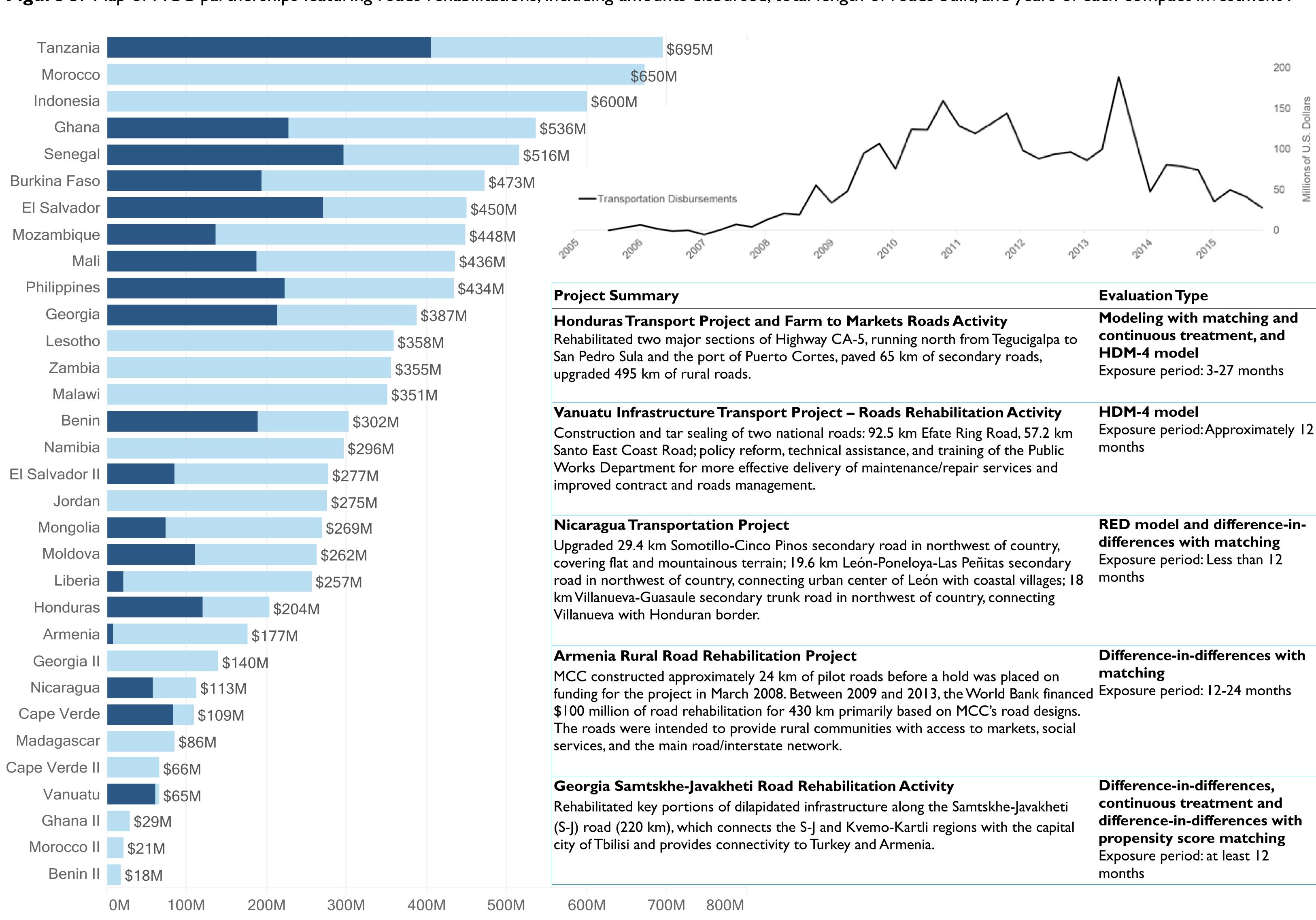


Figure 4. In the charts above, see MCC partnership total obligated funds (in light blue) and transportation obligated funds (in dark blue). Transportation projects amount to about one-third of total MCC investments. Transportation funding disbursements (line plot) were greatest in 2010 and 2013.

Figure 5. Completed transportation project evaluations, including project details and evaluation design.

Nicaragua and Vanuatu

KEY OBSERVATIONS AND CONCLUSIONS:

Project Costs

Evaluations estimated lower ERRs post-compact relative to those predicted at the investment decision. In Honduras and Nicaragua, increased project costs per kilometer led to the decreased ERR.

Traffic, Vehicle Operating Costs and Travel Time

Evaluations confirmed reductions in vehicle operating costs (VOC) and savings in travel times (TTS) and increased average annual daily traffic (AADT) in the majority of MCC's transportation projects.

Access to Markets and Social Services

Improved access to markets and services, (e.g. job and agricultural markets, health centers and schools) was identified as a project outcome in several of MCC's road investments. Statistically significant decreases in cost of travel to hospitals (\$0.17) and health centers (\$0.01) were identified in Honduras. In Armenia, perceptions of difficulty in accessing markets decreased, though there was no evidence of improved access to social services.

Goods Prices and Markets

In Honduras, Nicaragua and Georgia, expected project impacts included increased availability and lower costs for consumer goods. No price impacts were reported in the Honduras evaluation, and in Nicaragua, no statistically significant effect on prices or the availability of goods was found across the standard basket of consumer goods. The Georgia evaluation produced inconclusive results, with some prices increasing and others decreasing.

Incomes and Economic Activity

Expected high-level outcomes, particularly increased incomes for road beneficiaries, proved challenging to detect. In Armenia and Georgia, no evidence of increased incomes was observed. However, increased industrial facilities were observed in Georgia. In Honduras, household income effects were inconclusive as monthly agricultural income increased by \$3.50 and non-agricultural income decreased by \$5.

SELECTED REFERENCES:

Millennium Challenge Corporation. Chapter 2: Guidelines for Conducting a Constraints Analysis. https://www.mcc.gov/resources/doc/compact-development-guidance-chapter-2.

Ospina, S. and M. Block. 2015 Report on Closeout ERRs. 2016. https://www.mcc.gov/ resources/doc/report-2015-closeout-errs.

Chong, U., and O. Hopkins. An international experience on the evolution of road costs during the project life cycle. Transport Policy, Vol. 48, 2016, pp. 60–66.

Millennium Challenge Corporation. Evaluation Catalog. https://data.mcc.gov/evaluations/

Greg Morosiuk. HDM-4 Analysis of the Efate Ring Road and the Santo East Coast Road. Vanuatu, DDI-MCC-VUT-HDM4-IND-2011-v01, 2014.

Mathematica Policy Research. Rural Road Rehabilitation. Armenia, DDI-MCC-ARM-ROAD-MPR-2014-v1, 2014.

National Opinion Research Center (NORC). Transport and Farm to Market. Honduras, DDI-MCC-HND-IE-Trans-2014-v1, 2014.

Jonathan E. Alevy. Transportation. Nicaragua, DDI-MCC-NIC-IND-TRANS-2014-v1, 2014.

National Opinion Research Center (NORC). Samtskhe-Javakheti Roads. Georgia, DDI-MCC-GEO-GORBI-NORC-2013-v01, 2014.

MCC has published independent evaluations of five road MCC's transportation-focused partnerships have yielded several rehabilitation projects in Armenia, Georgia, Honduras, lessons in designing, implementing, and evaluating road projects to achieve high economic returns

• The specific problem a road investment is aiming to resolve must be clearly understood and should inform project development.

For a development agency focused on removing constraints to economic growth, the theory of change connecting a transportation project to economic growth and poverty reduction should serve as the foundation for project design and guide implementation decisions. MCC's road investments generally aim to address transportation sector constraints (e.g. high transportation costs for exports) or constraints in another sector that are influenced by transportation (e.g. agriculture). In either case, the key linkage between a road investment and economic benefits is traffic composition and volume. However, when a road investment is selected to ameliorate a non-transport specific constraint, the mechanisms for and likelihood of non-transport specific impacts must be investigated during project design. The challenge of translating likely non-transport impacts into projections for generated or induced traffic must continue to be explored.

Project selection should be based on a network analysis that allows for prioritization.

MCC's model espouses both country ownership and a reliance on evidence and analysis to inform investment decisions, and these principles may not always align perfectly. Partner countries may identify certain roads as key priorities for reasons that are not based in economics, but rather address other national priorities. MCC has learned that road investments should be identified in the context of the national road network or a targeted regional network analysis and is applying this practice to road investments that are currently being developed.

Policy and institutional issues in the transport sector must be addressed up front to ensure sustainability of road investments.

Institutional practices in road maintenance and network analysis are the most critical areas for planning, executing, and evaluating cost-effective, sustainable road investments. These areas have not been studied as closely as infrastructure-related issues in MCC's previous road projects, and this has put the sustainability of road investments at risk. For current projects, MCC is using network analysis and addressing road maintenance to further sustainability of its investments.

To better manage completion risk and improve investment value, road investments should undergo enhanced design review throughout the project cycle.

MCC is now collaborating with its country partners during the engineering design phase to determine the most cost effective and highest value design solution(s) through a value engineering review based on the ERR. Projects are monitored for conformity to design specifications during execution and are validated by all stakeholders at project completion.

Evaluation of road projects should better balance cost and the potential for learning.

MCC has attempted rigorous evaluations of road projects using methods such as VOCTTS modeling, propensity score matching, regression discontinuity, and difference-in-differences to measure changes in a variety of outcomes. Evaluations that went beyond VOCTTS aimed to measure economic gains experienced by populations living or working in the vicinity of the upgraded roads, rather than focusing on road-specific outcomes such as AADT or IRI. The learning that came out of these evaluations was not significant enough to warrant their high costs. MCC has since redesigned its evaluation approach to focus data collection more on intermediate outcomes related to road conditions and road users.

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