THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI

JANUARY 2022

REPURPOSING AGRICULTURAL POLICIES AND SUPPORT

Options to Transform Agriculture and Food Systems to Better Serve the Health of People, Economies, and the Planet

Madhur Gautam, David Laborde, Abdullah Mamun, Will Martin, Valeria Piñeiro, Rob Vos

1818 H Street NW,
Washington DC 20433
Telephone: 202-473-1000;
Internet: www.worldbank.org

REPURPOSING AGRICULTURAL POLICIES AND SUPPORT

Options to Transform Agriculture and Food Systems to Better Serve the Health of People, Economies, and the Planet

Madhur Gautam[1], David Laborde[2], Abdullah Mamun[2], Will Martin[2], Valeria Piñeiro[2], Rob Vos[2]

[1] Agriculture and Food Global Practice, Sustainable Development
[2] International Food Policy Research Institute

JANUARY 2022

ACRONYMS AND ABBREVIATIONS

AEZ	Agroecological zone
ALU	Agricultural production and land use
BCA	Border carbon adjustment
CAP	Common agricultural policy (European Union)
CES	Constant elasticity of substitution
CET	Constant elasticity of transformation
CFS	Committee on World Food Security
CGE	Computable general equilibrium
CO_2eq	Carbon dioxide (CO_2) equivalent
COP26	Twenty-Sixth Conference of the Parties of the UNFCCC (2021)
CoSAI	Commission on Sustainable Agriculture Intensification
CSA	Climate-smart agriculture
EC	Emission coefficient
EMDE	Emerging market and developing economies
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FOLU	Food and Land Use Coalition
FSIN	Food Security Information Network
GDP	Gross domestic product
GFR	Gross farm receipts
GHG	Greenhouse gas
GI	Green innovation
GNI	Gross national income
Gt	Gigatons
HLPE	High Level Panel of Experts (of the CFS)
IDB	Inter-American Development Bank
IFA	International Fertilizer Association
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change (United Nations)
IO	International Organizations Consortium
LES	Linear expenditure system
LUC	Land-use change
MAFAP	Monitoring and Analyzing Food and Agriculture Policies (FAO)
MToE	Million tons of energy use
NDC	Nationally determined contributions (UNFCCC)
NRA	Nominal rate of assistance
NRP	Nominal rate of protection
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing power parity
R&D	Research and Development
TFP	Total factor productivity
UNCAS	UN Climate Action Summit
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFSS	United Nations Food Systems Summit
WDI	World Development Indicators
WTO	World Trade Organization

Note: $ refers to US dollars.

FOREWORD

Providing nutritious and affordable food for a growing global population while protecting the vital natural systems that sustain life is one of the critical challenges of our times. Current agricultural practices have yielded impressive productivity gains, but are increasingly associated with high greenhouse gas emissions, biodiversity loss, and chronic disease, while leaving many rural people who depend on farming in poverty.

How can agricultural support policies be repurposed to make the food system deliver better outcomes? This was the broad question the World Bank and the International Food Policy Research Institute (IFPRI) sought to answer in this study. The report finds that there are important current and projected trade-offs for policymakers to consider as they work to deliver on the promise of food systems for sustainable development.

All solutions are not equal when it comes to rethinking agricultural public policies and support. The report finds that greenhouse gas emissions would increase substantially in the future if current policies are untouched. Simply rearranging or even removing current support would not bring about the changes needed for sustainability. Nor would applying environmental conditionality to the support provided while relying solely on currently available technologies: While it could help reduce emissions in the short term, lower yields could induce farmers to expand land use for agricultural production. Both changes in incentives and investments in innovations that simultaneously pursue productivity enhancements and greenhouse gas emission reductions are needed in order to deliver broad and long-standing wins.

The report finds that repurposing a portion of government spending on agriculture each year to develop and disseminate more emission-efficient technologies for crops and livestock could reduce overall emissions from agriculture by more than 40 percent. Meanwhile, millions of hectares of land could be restored to natural habitats. The economic payoffs to this type of repurposing would be large. Redirecting about $70 billion a year, equivalent to one percent of global agricultural output, would yield a net benefit of over $2 trillion in 20 years.

Most importantly, repurposing would deliver large benefits to people. It would raise rural incomes, contributing to improved food security. It would substantially reduce the cost of healthy diets, contributing to better nutritional outcomes. And it would accelerate poverty reduction.

At a time when farmers bear the brunt of worsening climate change impacts, volatile food prices, rising input costs, and shifting consumer demand, government support is much needed and could be much better targeted. The report uncovers that for every budgetary dollar spent under current farm policies, only 35 cents end up with farmers. In rethinking agricultural policies, governments must be mindful of farmers' bottom lines and the particularities of country and even local contexts. Indeed, farmers' support for policy changes, incremental or otherwise, will be key to the success of reform efforts.

We hope readers will find that this report makes a useful contribution to a growing literature on how to repurpose current agricultural policies and drive reform, as the World Bank and IFPRI, together with other partners, including FAO, work with policymakers to reexamine their support programs and chart ways forward for food systems that better benefit people, the planet, and the world's economies

Martien van Nieuwkoop

Global Director, Agriculture and Food Global Practice, World Bank

Johan Swinnen

Director General, IFPRI and Global Director for Systems Transformation, CGIAR

ACKNOWLEDGMENTS

This study was undertaken by a joint World Bank and International Food Policy Research Institute team comprised of Madhur Gautam, David Laborde, Abdullah Mamun, Will Martin, Valeria Piñeiro, and Rob Vos. Special thanks to Martien Van Nieuwkoop(Global Director), Louise Scura (former Practice Manager for Global Engagements) and Julian Lampietti (current Practice Manager for Global Engagements) at the Agriculture and Food Global Practice of the World Bank for their guidance and support from the conceptualization to the implementation of this study. This study contributes to the aims and objectives of Food Systems 2030, the World Bank's vision for transforming food systems to deliver healthier people, a healthy planet, and healthy economies.

The Food and Agriculture Organization of the United Nations (FAO) gracefully facilitated World Bank-sourced funding that made this study possible. The authors are also grateful to FAO staff, Marco V. Sánchez and Valentina Pernechele, for helpful comments to an early draft of the study. The authors further gratefully acknowledge the valuable inputs and feedback received at various stages of this study from Hanane Ahmed, Tobias Bedaeker, Eva Tortella Canellas, Raffaello Cervigni, Richard Damania, Ghada Elabed, Marianne Fay, Joshua Gill, Charlotte Hebebrand, Sebastian Heinz, Christine Heumesser, Stephen Ling, Michael Morris, Clare Jessica Murphy-McGreevey, Flore Martinant de Preneuf, Robert Townsend, Michael Toman, Dina Umali-Deininger, and Sergiy Zorya. The authors also thank the participants at the following seminars, workshops, and conferences for helpful comments on earlier drafts of this paper: an IFPRI policy seminar (April 21, 2020); the National Bureau of Economic Research (NBER) Spring 2020 Conference on "Agricultural Markets and Trade Policy" (April 30, 2020); the 23rd Global Trade Analysis Project (GTAP) Annual Conference on Global Economic Analysis (June 17, 2020); the UN Food Systems Summit Pre-Summit Parallel Event on "Repurposing Public Support to Food and Agriculture: A Just Rural Transition to Sustainable Food Systems" (July 26, 2021); the UN Food Systems Pre-Summit affiliated session "Rebalancing Public Agricultural Support for Health, for Prosperity and for the Planet – Policy Realities" (July 28, 2021); the Agricultural and Applied Economics Association Annual Meetings (August 3, 2021); the 31st International Conference of Agricultural Economists (August 28, 2021); the 49th Session of the Committee on World Food Security (CFS) side event on "Prioritizing Climate Resilience: Building a New Policy Consensus with Smallholder Farmers" (October 11, 2021); the Global Landscapes Forum (November 7, 2021); the 10th Asian Society of Agricultural Economists International Conference (December 7, 2021); and the Academy of Global Food Economics and Policy (December 9, 2021).

The publication and editorial services for this report were provided by the Translation and Interpretation Unit in the Global Corporate Solutions Department (GCSTI) of the World Bank.

OVERVIEW

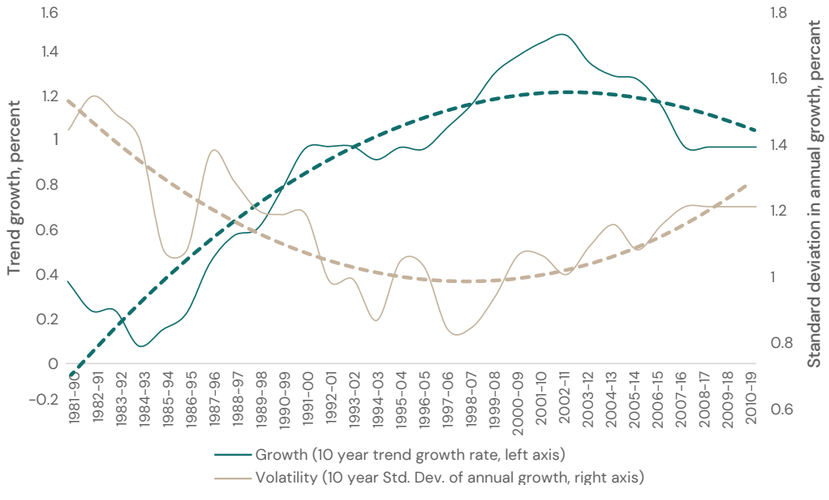
KEY MESSAGES

- Current governmental support for agriculture provides incentives for unsustainable patterns of production and consumption, with agriculture and land-use change responsible for 22 percent of global greenhouse gas emissions (GHG).
  - *Given a "business-as-usual" scenario of unchanged support, GHG emissions from agriculture would increase by 58 percent, and 56 million hectares would be converted to agricultural land between now and 2040.*
- Current support for agriculture delivers low value for money as a way of helping farmers; for every dollar of public support, the return to farmers is just 35 cents.
- Simple reductions in or rearrangement of current support will not yield game-changing reductions in global emissions.
- Policy conditionality tying support to the adoption of environment-friendly but lower-yielding farm practices could potentially reduce emissions, but would entail tradeoffs for people, nature, and economic prosperity with lower agricultural production, higher poverty, higher agricultural land use and an increase in the cost of healthy diets.
- Concerted efforts to repurpose a part of current domestic support as incentives to develop and adopt green innovations that reduce both emissions and costs could potentially deliver substantial gains for the planet, the economy, and people.
  - *Simulation results suggest that investments in innovations designed to lower emissions and raise productivity by 30 percent could reduce emissions from agriculture and land use by more than 40 percent, returning 105 million hectares of agricultural land to natural habitats, while delivering substantial gains in poverty reduction, nutrition, and the overall economy.*
- There is a strong case for policymakers to scrutinize and rethink their current domestic policies. The biggest gains would accrue through a coordinated effort of all countries to reset their policies to address the global threat of climate change, and to better meet nutritional and social needs.

Securing affordable access to a healthy, nutritious, and safe diet for the growing world population in the face of climate change and widespread resource degradation is a major global challenge. Demand for food is expected to increase rapidly between now and 2050. The world's population is projected to reach almost 10 billion by 2050, and per capita

incomes are rising rapidly. Agricultural performance in meeting the challenge of feeding the world over the past 60 years has been impressive, as food production has substantially outpaced population growth. However, continuing to meet global food needs successfully and sustainably is becoming increasingly difficult. Global hunger has been on the rise since 2015, and the growth in food output per capita has both decelerated and become more volatile (Figure O.1).

FIGURE O.1: Growth and Volatility Trends in Food Production Per Capita, 1980–2000

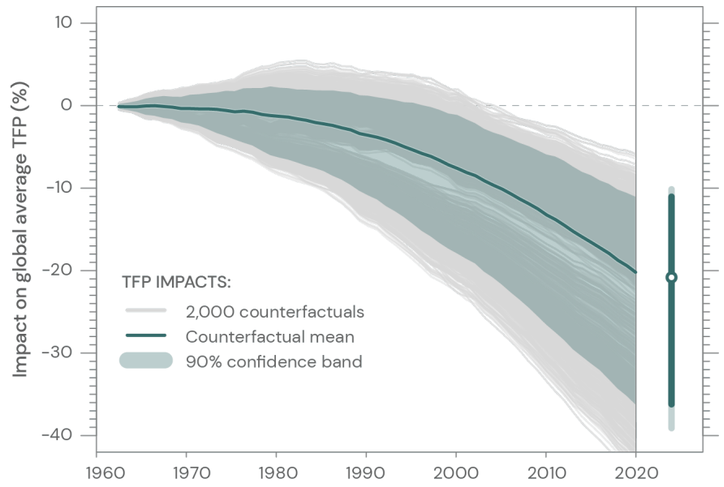


Source: FAOSTAT

Climate change is not a distant threat—it is already adversely affecting agriculture. Recent analysis indicates that since 1960 climate change has slowed productivity growth by 21 percent globally, and by as much as 40 percent in parts of Africa and other tropical zones. More worryingly, as shown in Figure O.2, this adverse impact appears to be intensifying, pushing the world more quickly toward a "tipping point" where climate change impacts will offset all productivity growth, and beyond which the economic and social consequences could be devastating.

While agriculture is highly vulnerable to climate change, it is also a major contributor to the problem. The agri-food system contributes about a third of the world's total anthropogenic GHG emissions. About two-thirds of these, or about 22 percent of the total, are generated on farms, from agricultural production and land-use change; the rest come from pre- and post-production activities in the broader agri-food system. Agriculture and food systems also generate other major negative externalities, including the loss of biodiversity, the degradation of natural resources, and the adverse effects on human health of costly nutrition-adequate diets.

FIGURE O.2: Impact of Climate Change on Productivity, 1960–2020

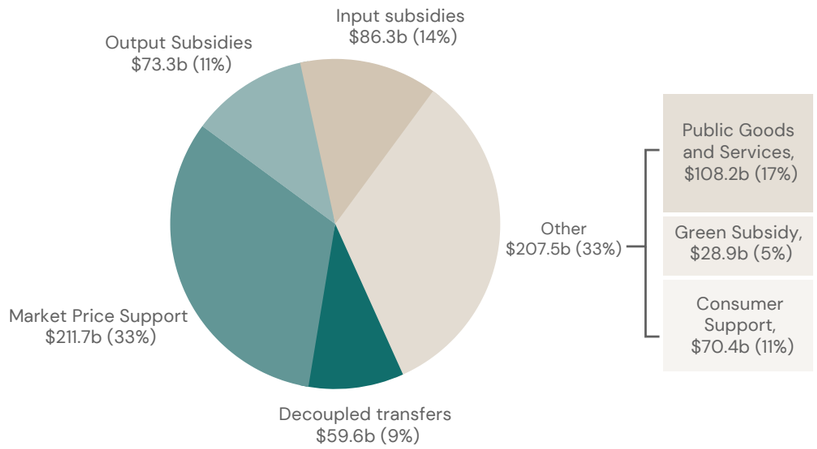


Source: Ortiz-Bobea et al. 2021.

Building better food systems requires a fundamental change in incentives. This study finds that if countries continue on a "business-as-usual" path by keeping current policies in place, emissions from agricultural production would double by 2040, and an additional 56 million hectares of new land would be converted to agriculture between 2020 and 2040. These outcomes reflect the patterns of production and consumption that have emerged, influenced in part by incentives created through longstanding governmental measures taken to support agriculture. In 2016–18, the governments of the 79 countries for which data are available supported agricultural production and food consumption with measures that generated net transfers of $638 billion per year (Figure O.3). More than 70 percent of this total support, about $456 billion, consisted of support for agricultural producers, of which 82 percent was provided through measures that the Organisation for Economic Co-operation and Development (OECD) refers to as "potentially most distorting." These include subsidies linked to outputs, inputs, or production factors like land area (referred to as ***domestic support*** in this study) as well as market price supports provided through trade restrictions such as import tariffs and other border measures (referred to as ***trade barriers*** in this study). About 11 percent of the total support was provided to poor consumers, for instance through public food assistance or food distribution programs. Of the remainder, about 17 percent was for public goods and services like research and irrigation, and another 5 percent was "green" subsidies, that is, subsidies to support better environmental outcomes. Governments have been providing these broad types and levels of support to agriculture and food systems for

a long time. This public support has helped to raise productivity and lower the price of food, especially of basic staples such as cereals; but it has also promoted the unsustainable patterns of production and unhealthy diets that characterize today's food systems.

FIGURE O.3: Total Annual Support to Agriculture Provided by 79 Countries, 2016–18 (in billions of current dollars and percentage share)



Source: Authors, using data from AgIncentives International Organizations Consortium.
Note: b=billion

Could the current support to producers be repurposed to deliver better outcomes? Given the scale and structure of the support to agricultural producers globally, this study assesses several options for repurposing current agricultural policies and support to achieve better economic, environmental, social, nutritional, and climate outcomes. The scenarios analyzed are:

0. ***Baseline:*** A business-as-usual (or "zero") scenario simulates a "no policy change" option that assumes current policies and patterns of producer support will continue unchanged.
1. ***Removal:*** Two scenarios consider the removal of two distinct forms of producer support:
   a. Remove the current domestic support provided to producers.
   b. Remove both domestic support and trade barriers or market price supports.
2. ***Restructuring:*** Two forms of restructuring domestic support that would rely on currently available technologies and practices are analyzed:
   a. Replace the current pattern of support, which targets certain agricultural products, with a uniform rate of support for all agricultural products.
   b. Target current domestic support to only low-emission intensity products.
3. ***Conditionality***: In this scenario, producer support would be conditional on farmers adopting emission-reducing practices, using currently available technologies.
4. ***Repurposing:*** In this scenario, a portion of current domestic support would be repurposed for increased spending on green innovations; that is, the development, diffusion, and adoption of new technologies that both reduce emissions and raise productivity. The remainder would be returned to taxpayers and would be potentially available to deliver as nondistorting transfers to producers and other stakeholders. This could be used to compensate them for potential losses due to this reform, and to spend on rural infrastructure and other essential public goods and services that are fostering agricultural and rural development.

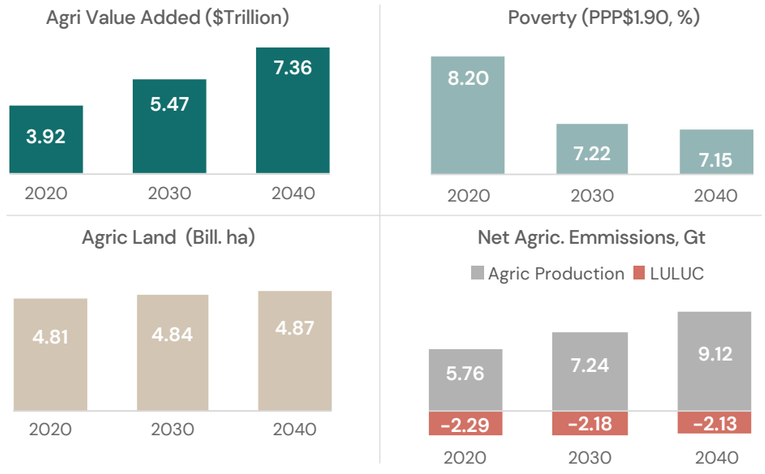
BOX O.1: METHODOLOGY

Using the International Food Policy Research Institute's (IFPRI's) global general equilibrium model, MIRAGRODEP, this study analyzes the likely impacts of several different policy options on the planet (that is, on GHG emissions and land use); the economy (national income); and people (poverty, food security, and the cost of a healthy diet). These scenarios assess the potential effects of removing, restructuring, attaching conditionality to, and/or repurposing current domestic producer support.

Our analysis assumes a phased implementation of reforms and focuses on longer-term outcomes rather than immediate impacts. In all of the scenarios, reforms are assumed to be implemented gradually over a five-year period (2020–2025), and impacts measured against a projected baseline for 2020–2040. This would allow the investment and consumption responses to changes in income resulting from the reforms to be fully incorporated when considering outcomes.

0. Baseline. **A "business-as-usual" (or zero) scenario with unchanged policies projects a substantial increase in agricultural emissions by 2040.** Figure O.4 shows the projections for key outcomes. From 2020 to 2040, in line with past trends, agricultural value added would increase by about 3 percent per year, and emissions from agricultural production would double. In this business-as-usual scenario, agricultural land use is projected to increase by 1 percent, equivalent to drawing *56 million hectares of new land into agriculture from 2020–2040*. This expansion of agricultural land would increase losses in biodiversity and ecosystem services; increase emissions as a result of forest conversion to farmland; and reduce carbon sequestration capacity by 7 percent.

FIGURE O.4: Baseline Projections, 2020-2040



Source: Authors' baseline scenario projections.

***1. Removal:* What is current agricultural support "buying"?** This question is addressed by the first set of complementary scenarios (1a and 1b), which assume the removal of domestic support and of all producer support, including market price support (Figure O.5).

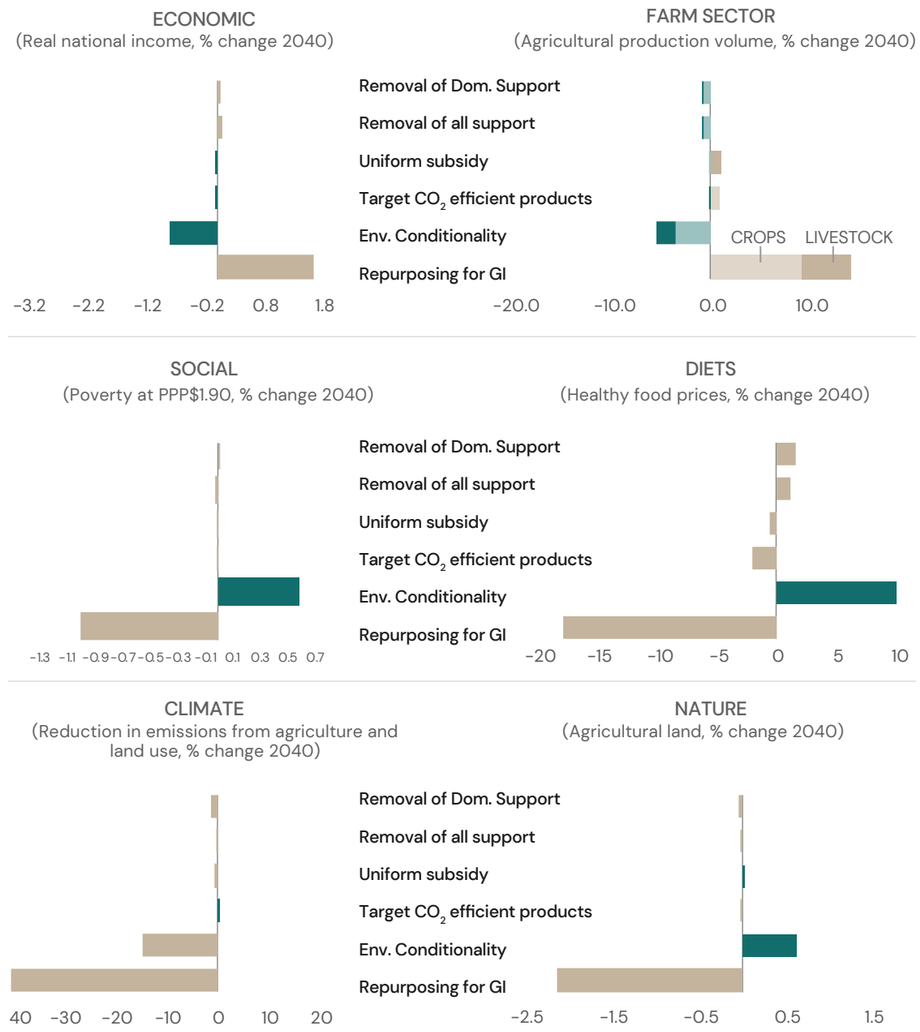
- **A simple removal of domestic producer support would involve important trade-offs.** Removing domestic support (Scenario 1a) would have small but favorable impacts on the climate and on nature by reducing agricultural GHG emissions by the equivalent of about 103 megatons of CO_2 (CO_2eq), or 1.5 percent of total agricultural emissions in the baseline, as well as reducing the territorial footprint of agriculture, saving 27 million hectares, or about 49 percent of the projected conversion of land to agriculture. However, these environmental gains are far short of what is needed to appreciably curb agriculture's contribution to climate change. Moreover, the economic outcomes would be mixed. On the one hand, removing distortionary domestic support would generate some efficiency gains, reflected in a small increase in real world income of $74 billion (0.05 percent) per year relative to the baseline projections for 2040. On the other hand, major political economy challenges would be likely to emerge as farm output and real farm income per worker would decline, reinforcing policymakers' concerns about food security and the welfare of farmers. *The current farm-support regimes were not designed to reduce poverty or to improve diets, but their abolition would likely increase food prices, contributing to more poverty (albeit marginally) and raising the cost of healthy diets.*
- ***This scenario also reveals that the vast public resources spent to benefit farmers is delivering very little "value for money."*** Domestic support to producers costs around 14 percent of agricultural value added but yields an increase in real value added of only 5 percent. If farm support is thought of as providing transfers to farmers, its implied *transfer efficiency is very low,* at only about 35 percent. In contrast, lump-sum transfers (that is, payments to producers that are not linked to inputs or outputs) would almost triple the gains to farmers, while avoiding the distortions created by current forms of support.
- ***Removing trade barriers as well as domestic support would yield somewhat greater income gains but would limit the reduction in emissions.*** Trade barriers in the form of import tariffs support production but tax consumption in protecting countries. Their removal (Scenario 1b) would thus have partially offsetting effects on supply and demand. Economic efficiency gains would be larger if both trade barriers and domestic support were reduced (which would be about $135 billion, or 0.09 percent in 2040), and global poverty would fall slightly. With a more muted decline in global agricultural output as compared to removing only direct support, however, this *more comprehensive reform would limit the reduction in global GHG emissions induced by the removal of domestic support* to about 39 megatons of CO_2eq, or 0.55 percent of total agricultural emissions in the baseline. This muted impact is explained in part by the effect of removing protection on food prices, which would fall in protecting countries, thereby increasing global demand for food and offsetting some of the decline in global production from the removal of domestic support.

Approaches that specifically aim to reduce emissions can be game changers for agriculture's impact on climate change; but they require careful consideration of current and projected trade-offs. The options for maintaining but redirecting domestic support to agriculture considered in this study are representative of a broad range of specific policy options that are conceptually similar but that need to be tailored to individual country contexts. The impacts of selected repurposing options are shown in Figure O.5 and compared with those of the previous scenarios involving the removal of current supports. These scenarios assume an international consensus, under which all governments would repurpose support toward common global objectives.

2. Restructuring. **Maintaining support for agriculture at the current levels but restructuring it either by moving to uniform rates of assistance for all products, or by favoring low-emission products would yield surprisingly small economic, social, and environmental gains.** Replacing the current highly variable system of agricultural support with a uniform rate (Scenario 2a) mimics a shift toward decoupled transfers and would remove the present bias toward certain products. However, moving support away from high-emission to low-emission intensity products (Scenario 2b) would have surprisingly little impact on emissions. Paradoxically, transferring all subsidies to low-emission crop cultivation would actually *increase* global emissions by increasing demand for cropland and stimulating land-use change from forests, even though some pastureland would be retired as livestock production fell. These outcomes suggest that while this scenario is appealing at face value, merely shifting subsidies away from emissions-intensive commodities would do little in terms of overall emission reduction.

3. Conditionality. **Making support "conditional" on reducing emissions would be positive for planetary health but could entail trade-offs for people and economic prosperity.** Promotion of production methods and practices that improve environmental outcomes but reduce the productivity of land (Scenario 3) could potentially deliver important reductions in GHG emissions; but it might also come with economic and social costs. Drawing on the literature on emission reductions and cost increases associated with existing policy proposals for this type of conditionality, an illustrative simulation makes farm support conditional on production techniques that reduce emission intensities by 10 percent, while raising costs by the same amount. This would reduce global GHG emissions from agricultural production by 19 percent through the reduction in emissions per unit of output, and a decline in global output. But this gain would be offset by increases in emissions from land-use change, because additional land would need to be brought into agriculture. The net reduction in emissions from agriculture and land-use change would be 15 percent. This gain would come at cost of a 0.8 percent decline in global income, and a drop of more than 5 percent in agricultural production, while poverty and the cost of a healthy diet would both increase. Decreased biodiversity would incur additional losses since an increase in the use of land for agriculture would result in the loss of forest habitat.

FIGURE O.5: Global Implications of Repurposing Domestic Support (Percentage Change Relative to Baseline Projections for 2040)



Source: Authors, using model simulation results.
Note: ***Brown bars*** indicate movement toward, and ***teal bars*** indicate movement away from achieving the related SDG(s). GI= Green Innovation.

4. Repurposing for green innovation. **The repurposing option, which would redirect a part of domestic support toward targeted investments in technologies that are both productivity-enhancing and emissions-reducing, appears to hold the potential to deliver "triple wins" for a healthy planet, economy, and people.** The key point of departure in the final option considered (Scenario 4) is the focus on green innovation;

that is, *technologies and practices that would reduce emissions while increasing productivity*. Recognizing that achieving this is not without cost, the focus of this scenario is on redirecting some of the domestic support currently provided to agriculture toward more public spending on research and development (R&D), and incentives for the development and adoption of green innovations. Some such innovations already exist or are emerging. Based on an examination of the literature on the potential of recent innovations to raise productivity and reduce agricultural emissions, this illustrative scenario assumes a 30 percent increase in production and a 30 percent reduction in emissions per unit of output. The literature on past agricultural productivity growth suggests that the cost of raising agricultural productivity by 30 percent on a sustainable basis would be roughly equivalent to one percent of the value of farm output. This scenario considers repurposing the equivalent of one percent of the value of farm output from the current domestic support for agriculture to invest in R&D, under the assumption that with reoriented R&D priorities, this level of research intensity would also apply to the generation of green innovations. The remaining domestic support would amount to a saving for taxpayers and would be potentially available to deliver as nondistorting transfers to producers and other stakeholders to compensate them for any losses they might incur due to this reform, and for spending on extension services, rural infrastructure, and other essential public goods and services that are fostering agricultural and rural development. The importance of green innovations in delivering these wins is clear from Figure O.5, which shows the results of the repurposing scenario.

- ***Global real income would be higher, reflecting large economic efficiency gains.*** In 2040, the projected world income would be 1.6 percent higher than the business-as-usual projection.
- ***Adoption of these improved technologies would deliver huge benefits for the climate and nature.*** Between 2020 and 2040, overall emissions from agriculture would fall by more than 40 percent, or nearly 2.8 Gt CO_2eq—avoiding nearly 80 percent of the incremental emissions expected under the baseline (business-as-usual) scenario. Productivity growth would also release production factors (for a given level of demand), including land. About 2.2 percent ***less*** agricultural land would be needed in this scenario, releasing about 105 million hectares of agricultural land for restoration to natural habitats, with potentially substantial biodiversity benefits. This approach would spare not only the additional 56 million hectares of land that would be transferred to agriculture between 2020 and 2040 under the baseline scenario but would also release another 48 million hectares currently being used for agriculture that could be restored as natural habitats.
- ***Productivity-driven growth reduces poverty and makes nutritionally adequate diets more affordable.*** In this scenario, global extreme poverty would fall by 1 percent, while the cost of a healthy diet would drop by a substantial 18 percent.
- ***Incomes of farm workers would increase, while farm employment would fall as part of structural economic transformation over the long term—between now and 2040.*** The repurposing of current agricultural support could facilitate farm labor moving into other parts of the economy, because some of this money could be spent instead on human capital and skills development, as well as on rural financing and infrastructure. Through structural transformation, farm labor could become more productive both within agriculture and in nonfarm work if governments invested more in the human capital of rural people.

Notwithstanding the substantial potential gains for people, the planet, and the economy that could result from the repurposing options discussed in this study, current agricultural support measures need to be carefully scrutinized in various country contexts. A key insight from this study is that current agricultural support is a very blunt instrument for fighting climate change and for addressing the challenges of global food security and nutrition. There appears to be great potential for achieving major gains on these fronts by repurposing support toward public investments that facilitate the widespread adoption of productivity-enhancing and emission-reducing technologies for agri-food systems. Further, these policies are likely to have strongly positive international spillovers. Innovations that reduce environmental impacts and raise productivity are likely to either be rapidly adapted in other countries, or to provide a basis for developing technologies for other agroecological environments.

Nevertheless, even the best-designed policy reforms will face political hurdles. Agricultural support policies are the prerogative of national governments. Overcoming national resistance to agricultural policy reform from affected stakeholders will be a huge challenge. National farm and agricultural policies have a long history in most countries and have developed well-established entitlements and vested interests. Recognition of the major private and societal gains to be achieved, and multistakeholder engagement to discuss the potential trade-offs associated with policy options and to devise acceptable strategies should help to earn political support for smart repurposing of existing support at the national level.

For reforms to foster sustainable global development, effective policy coordination and technological innovations that are attractive to both individual producers and governments are needed. At present,

agricultural support is distributed unevenly across nations. Poorer nations have less fiscal space with which to provide agricultural support. Also, their national agricultural research systems generally have weaker resource capacity for developing high-productivity and sustainable farm technologies and practices relevant to the local context, and their farmers and other food producers face bigger obstacles in adapting those practices. Hence, to be most effective at the global level, a more even-handed diffusion of both technologies and financial resources is needed in order to allow countries to reap the benefits of agricultural policy reform and contribute most effectively to solving global challenges.

International coordination is vitally important to achieve the needed reductions in global emissions from agriculture. Climate change and environmental sustainability are global challenges that transcend borders, and national policies have strong international spillover effects. Policymakers are well-placed to scrutinize and rethink domestic policies – but ultimately all countries need to act together to effectively address the global threat of climate change to our food systems.