The Coalition of Finance Ministers for Climate Action

MINDSET: an easy-to-use sectoral model covering 164 countries

World Bank

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Overview

MINDSET[1] is a macroeconometric input-output model that assesses the impacts of climate change, adaptation measures, and mitigation strategies with high sectoral and regional granularity. The model covers 120 economic sectors in 164 countries. It informs a broad range of climate impacts as well as fiscal, price-based, and regulatory policies (see Table 1). It may be linked to the FTT[2] models of technology diffusion to capture within-sector transitions. Sector- and country-specific, single or multi-country scenarios may be assessed. Key outputs from the model include standard macroeconomic indicators, plus sectoral emission levels, production, and employment. By linking to national labor force and household survey data, impacts on workers and consumers can be analyzed across income strata, skill levels, occupation types, and subnational provinces, providing relevant information for active labor market and reskilling interventions and sectoral or regional government support funds.

Table 1. Climate impacts, policy scenarios, and metrics of interest for policy advice

Climate impacts and policy scenarios	Metrics of interest for policy advice
Acute climate impacts: e.g., floods, storms, or wildfires, quantified by direct production losses Chronic climate impacts: e.g., heat stress or loss of productivity Carbon prices: commodity or carbon tax, subsidy, and tariff changes, differentiated by commodity and sector Carbon Border Adjustment Mechanism (CBAM): single- or multi-country trade scenarios, differentiated by sectors Labor tax reforms, differentiated by skill level Income tax reforms Sectoral public spending, cross-funded or additional Sectoral public investment, cross-funded or additional Electricity and transportation sector policies (with sectoral models)	Sectoral job losses/gains by: • Occupation and skill level • Income group • Gender and age • Spatial: province/region GDP, output (sectoral) Tax revenue collection (by sector) Emissions effects (greenhouse gas + local) Sectoral consumer price changes and consumption incidence across income groups Competitiveness and sectoral import and export changes

Key strengths

MINDSET is an empirically grounded model that assumes bounded rationality and knowledge limitations. It combines the strengths of input-output analysis with those of a demand-led macroeconometric model. Based on a global multiregional input-output database[3] and linked to IEA energy balances, the core element of the model is the detailed network of linkages between sectors and countries along global value chains. Model results capture first-round direct, indirect, and induced supply-chain impacts that feed into fiscal multipliers. MINDSET incorporates sectoral and cross-country spillovers from global phenomena such as climate change, from domestic climate policies affecting competitiveness, and the policies of other countries, e.g., carbon pricing, and carbon border

1 Model of Innovation in Dynamic Low-Carbon Structural Economic and Employment Transformations.
2 Future Technology Transformations model, see https://www.e3me.com/what/ftt/
3 GLORIA (Global Resource Input-Output Assessment) is a Multi-Regional Input-Output (MRIO) database (see 'Lenzen et al. 2021).

adjustment mechanisms (CBAMs). The ability to inform policymakers about short-term distributional and sectoral frictions sets it apart from other CGE models and aggregate models.

Limitations

MINDSET's main limitations concern capacity constraints and within-sectoral transitions. The model assumes derived demand will be met by additional supply. In contrast to equilibrium assumptions, it assumes excess labor supply at existing wages (involuntary unemployment or underemployment) and no crowding out of investment (spare economic capacity).[4] Scenarios where capacity constraints may impact transitions require off-model analysis. Introducing supply-side constraints, such as from immobility of labor and climate damages, is under development or at an early implementation phase.

Relevance to Ministries of Finance

MINDSET can provide MoFs with granular, yet cost-effective and quick policy impact assessments. Quantifying the sectoral implications of policy-induced structural change is crucial for informing climate-fiscal reforms and complementary social security and labor policies, while being aware of the expected winners and losers. Outputs relevant to MoFs include sectoral tax revenues and price impacts on consumers, sectoral job losses/gains, GDP, emission reductions, and competitiveness effects (see Table 1). MINDSET does not include budgetary accounts or debt but does include information on taxes in sectors that can be simulated to understand their broader economic implications. For instance, linked to models of technology diffusion, MINDSET can assess transition impacts on fuel taxes from shifts to electric vehicles.

Key policy and analytical questions

MINDSET can help answer key policy and analytical questions. Examples are:

- What are the economy-wide effects of externally determined climate damages on vulnerable sectors, and how can disruptions in some sectors have knock-on effects on downstream industries?
- What are the risks posed by climate change and policies on indirect tax receipts, sectoral production, and employment?
- What are the short-run GDP and labor demand impacts of sectoral investment packages?
- What are the co-benefits and economic impacts from low-carbon transitions in the electricity and transportation sectors?
- How can relatively detailed identification be made of winners and losers from policy or climate change by geographic, sectoral, and income strata?
- What are the economy-wide and sectoral competitiveness risks of border adjustment mechanisms?
- Which active labor market and reskilling interventions may facilitate job reallocations and ease frictional costs from occupation-specific skills shortages?

Use in practice

MINDSET is designed to support actionable policy advice. It provides a tractable framework for understanding the drivers of policy effects and their respective transmission channels. User-friendly templates for scenarios and model parameters facilitate its accessibility. Access is only available through World Bank engagement, but there are plans for a web-based user interface and an open-source version of the model in the medium to long term. Several options can be considered to help MoF leadership develop in-house capacity for independent use of the model in the future.

4 Manufacturing sectors in Europe typically operate at around 80% of their capacity, with variations depending on the economic cycle. Levels tend to be lower in lower-income economies, see the data set at https://doi.org/10.2908/TEIBS070

Future work

MINDSET is a relatively new model, with many ongoing developments. Key components, including price formation, investment, and trade effects, are being revised to improve empirical relationships. Financial stocks and flows will be better integrated. A supply-side treatment based on economic complexity will inform labor supply bottlenecks as well as potential suppliers of new technologies and minerals.

Analysis in action

The model has been used to inform macro, sectoral, distributional, and employment outcomes in the Philippines, Bangladesh, and Cambodia CCDRs (World Bank Group, 2022a,c, 2023). MINDSET has also been used to inform how the EU CBAM might affect the economy and workers in Bosnia and Herzegovina (World Bank Group, 2024). Diagnostics have helped the Moroccan MoF understand the sectoral and distributional job effects of an liquefied petroleum gas (LPG) subsidy, carbon taxation, and health insurance reform. In Malaysia, sectoral impacts of floods and other climate damages contributed to an analysis of the banking sector's loan portfolios' exposure to climate risks (World Bank Group and BNM, 2022).

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