Open Economy: The 123 Model

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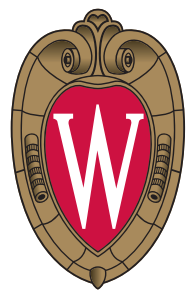

Computable General Equilibrium Models

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- GTAP: global model, more detail (next Monday)

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- Devarajan-Go-Lewis-Robinson-Sinko (1997), Chapter 6 of *Applied methods in trade policy analysis: A Handbook*, Francois and Reinert, eds., Cambridge University Press.

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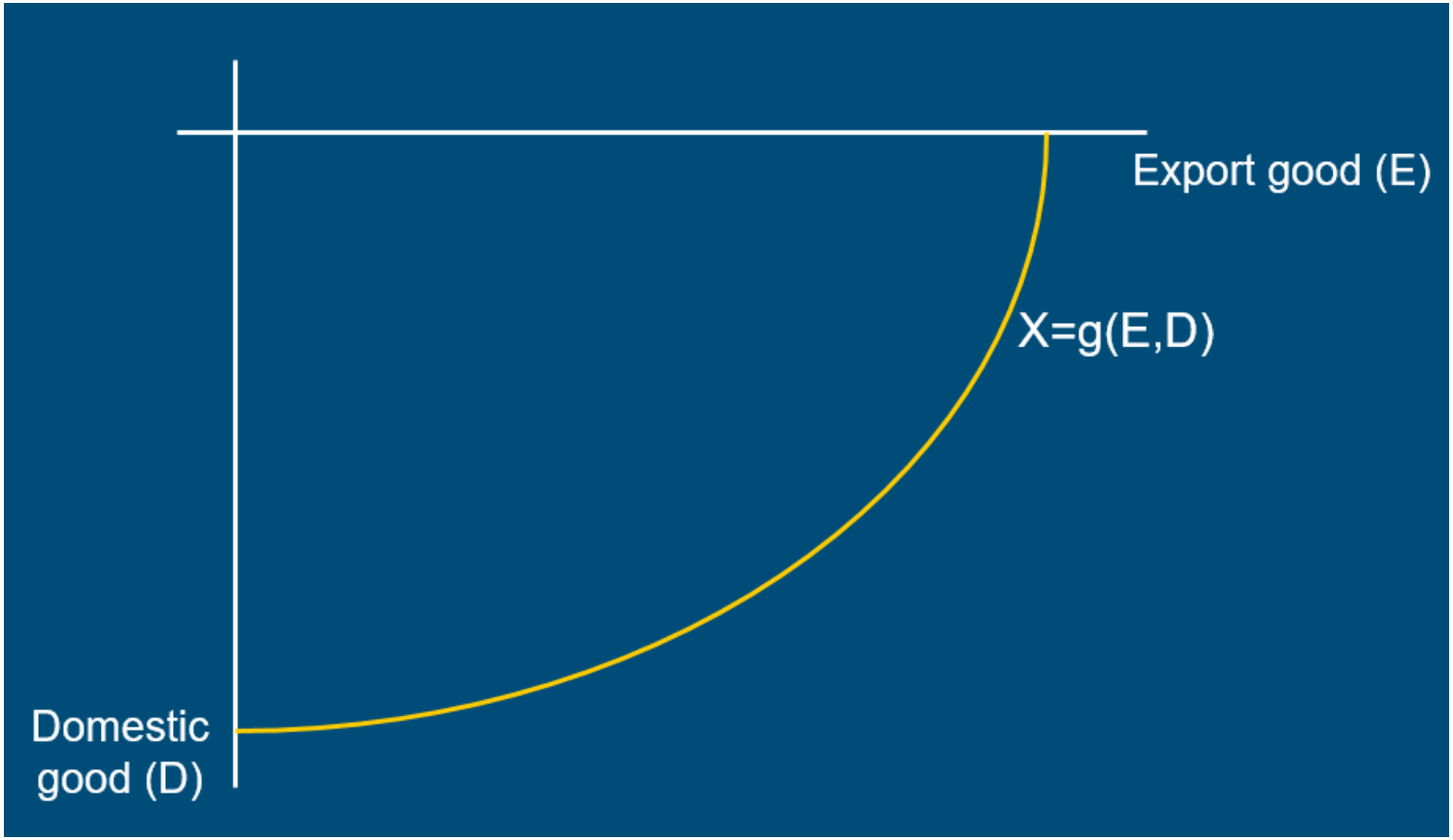
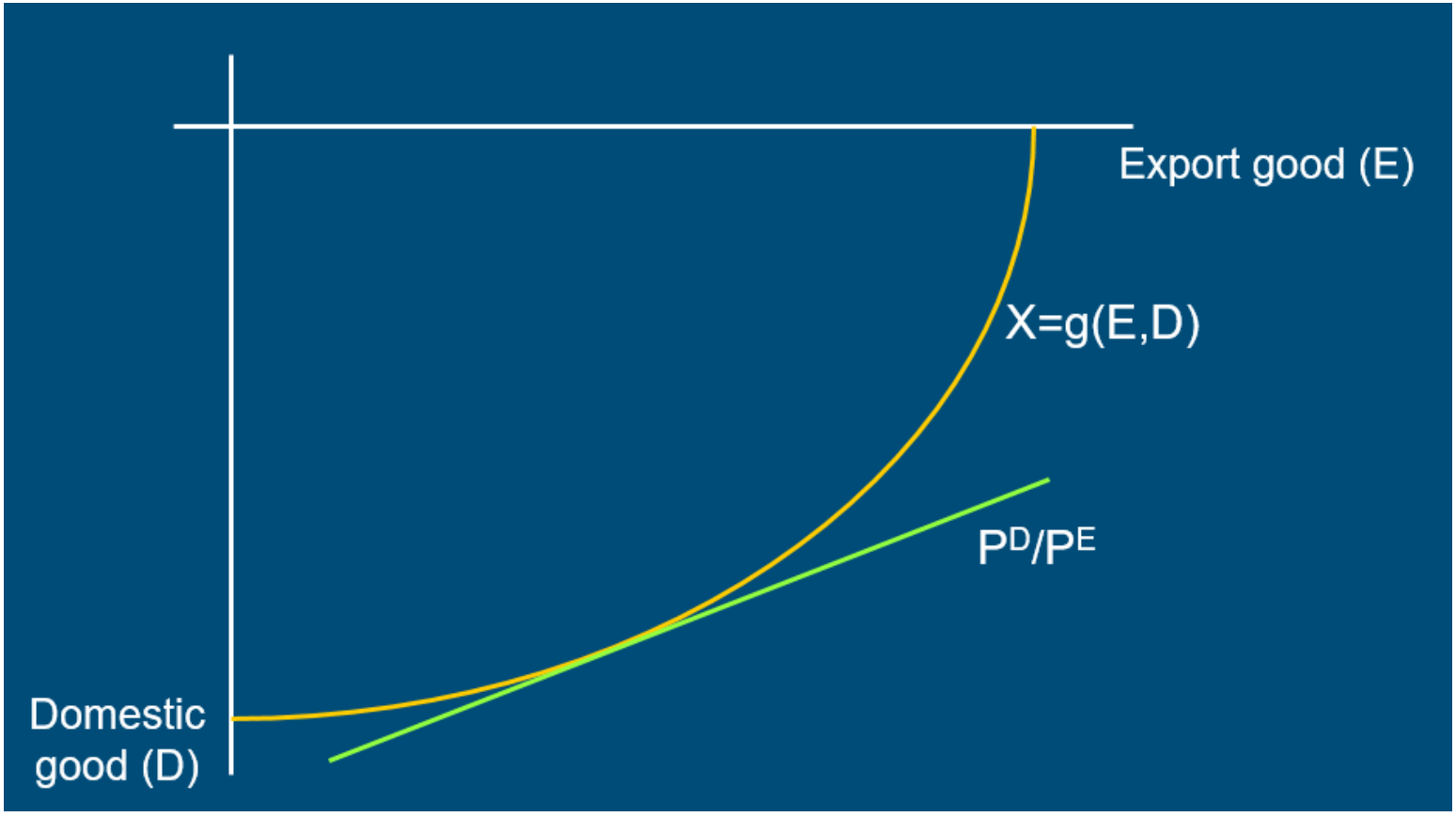
- Balance of trade (foreign exchange price π, market clearance). N.B. Both exports and imports are denominated in units of foreign exchange.

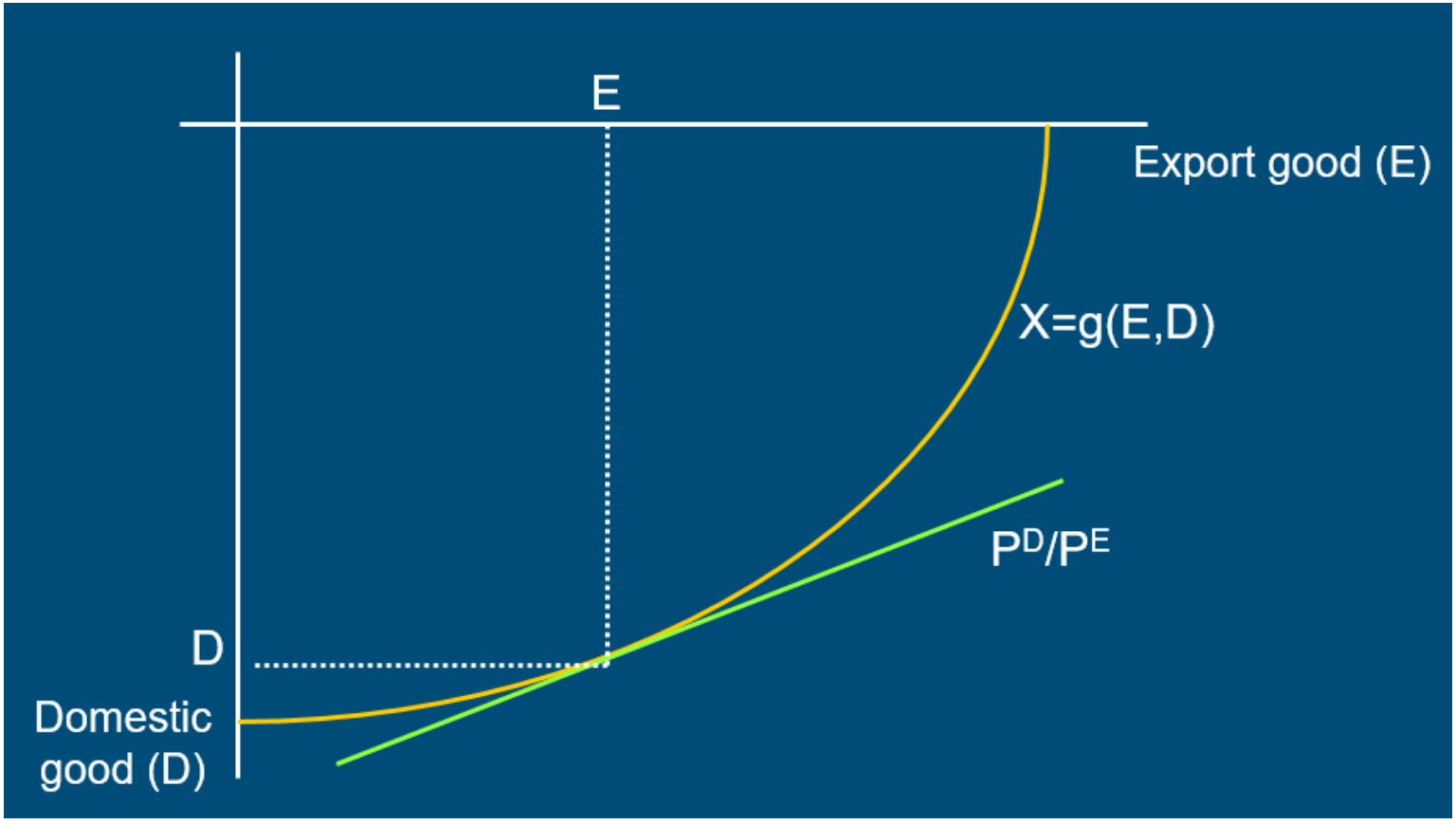
Supply Technology



Optimal Supply



Relative Prices and Optimal Supply



Differentiated Goods Supply: Details

Adopt a *constant elasticity of transformation* technology:

$$X = g(E, D) = \left(\theta_E \left(\frac{E}{\bar{e}} \right)^{\rho_E} + (1 - \theta_E) \left(\frac{D}{\bar{d}} \right)^{\rho_E} \right)^{1/\rho_E}$$

where X is an *index* of resource inputs to domestic production (when $E = \bar{e}$ and $D = \bar{d}$, $X = 1$.)

- $\bar{d}$ Benchmark production for the domestic market (when we use Harberger normalization: $\bar{p}_E = 1$ and $\bar{p}_D = 1$.
- $\bar{e}$ Benchmark exports
- θ_E Export value share:

$$\theta_E = \frac{\bar{e}}{\bar{e} + \bar{d}}$$

Linear Homogeneity

$g(E, D)$ is linearly homogeneous, i.e.

$$g(\lambda E, \lambda D) = \lambda g(E, D) \quad \forall \lambda > 0.$$

We therefore can solve for optimal coefficients:

$$\max_{a_E, a_D} p_E a_E + p_D a_D \quad \text{s.t.} \quad g(a_E, a_D) = 1$$

Points on a unit isoquant satisfy:

$$\theta_E \left(\frac{a_E}{\bar{e}}\right)^{\rho_E} + (1 - \theta_E) \left(\frac{a_D}{\bar{d}}\right)^{\rho_E} = 1$$

Points on the Supply Frontier

Expressing a_E as a function of a_D, we have:

$$a_E = \bar{e}\left[\frac{1-(1-\theta_E)(a_D/\bar{d})^{\rho_E}}{\theta_E}\right]^{1/\rho_E}$$

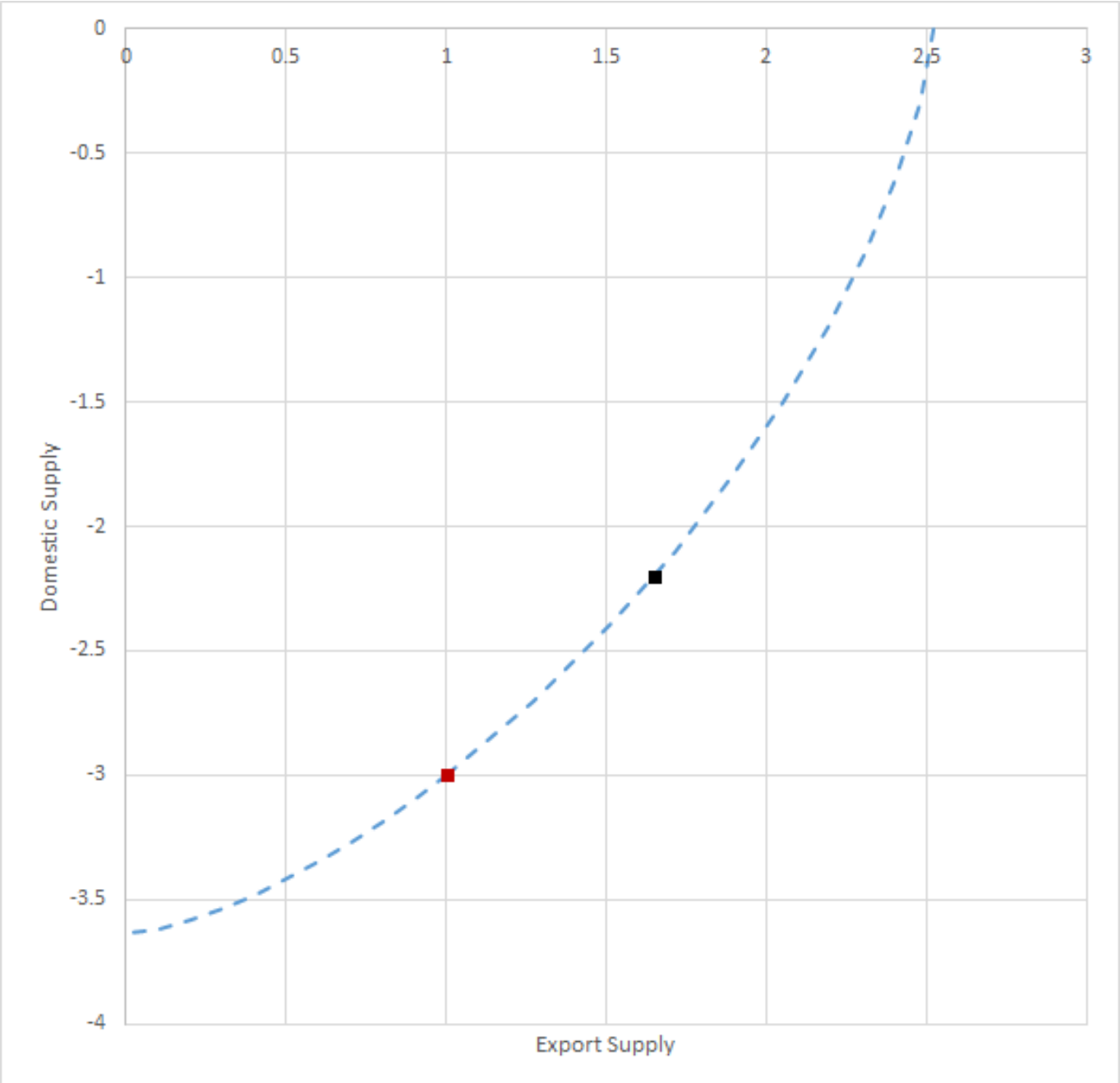
Expressing D as a function of E, we have:

$$a_D = \bar{d}\left[\frac{1-\theta_E(a_E/\bar{e})^{\rho_E}}{1-\theta_E}\right]^{1/\rho_E}$$

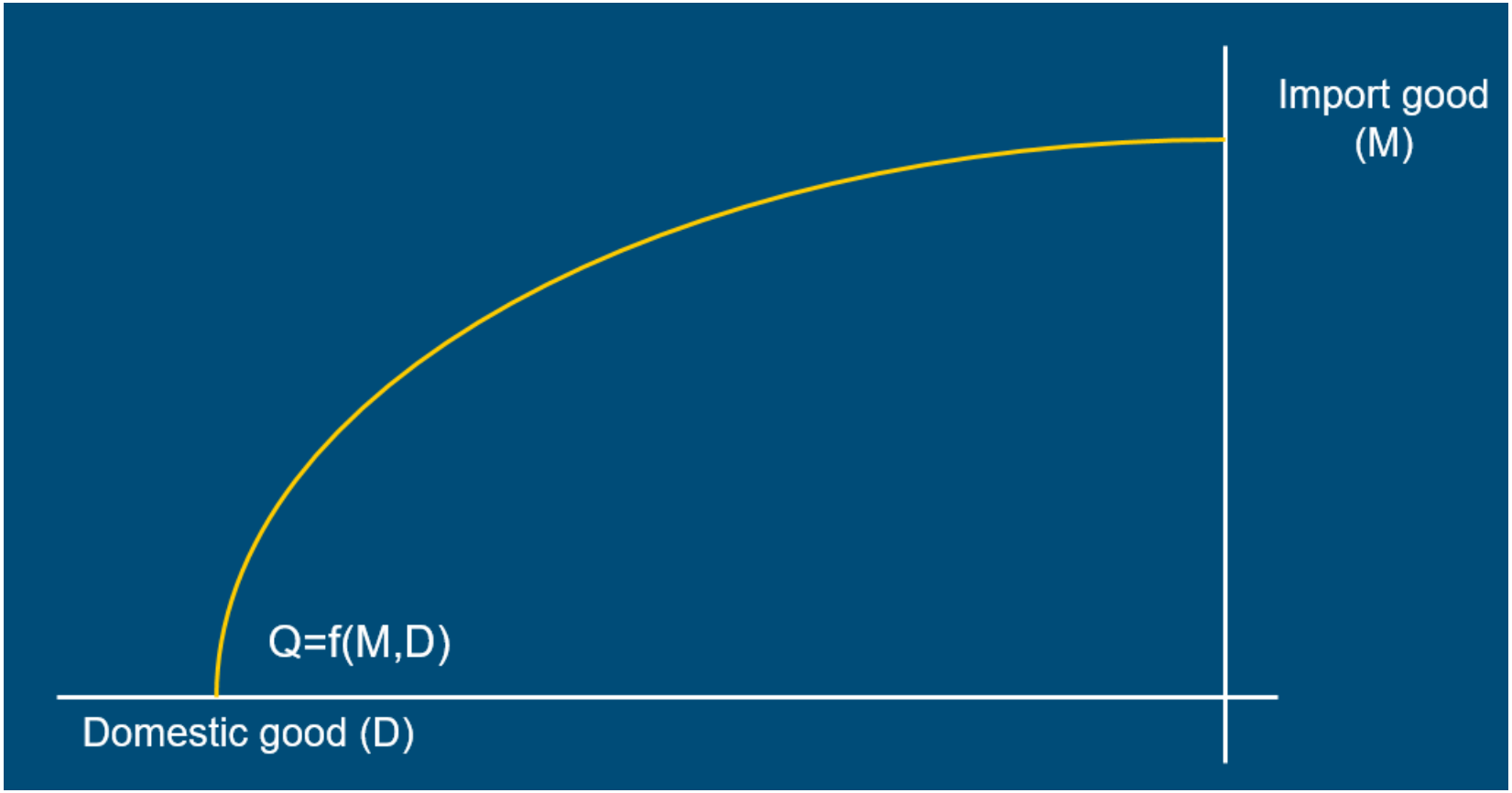
Domestic-Export Supply in Excel

123 Model Graphics				
Input Data				
Reference level of exports	e0	1		
Reference level of domestic goods	d0	3		
Elasticity of transformation	etadx	2		
	rhodx	1.5		
	thetae	0.25		
Reference level of imports	m0	1		
Elasticity of substitution	esubdm	2		
	rhodm	0.5		
	thetam	0.25		
Counterfactual Data				
Price of domestic goods	pd	1		
World price of imports	pm	1		
World price of exports	pe	1.5		
Real exchange rate	pi	1		
Counterfactual Equilibrium				
Revenue function	R	1.168082		
Export supply	E	1.649057		
Domestic Supply	D	2.198743		
Unit Isoquant (see notes)	E/e0	D/d0	E	D
	1	1	1	3
	0.9	1.032227	0.9	3.096682
	0.8	1.062254	0.8	3.186762

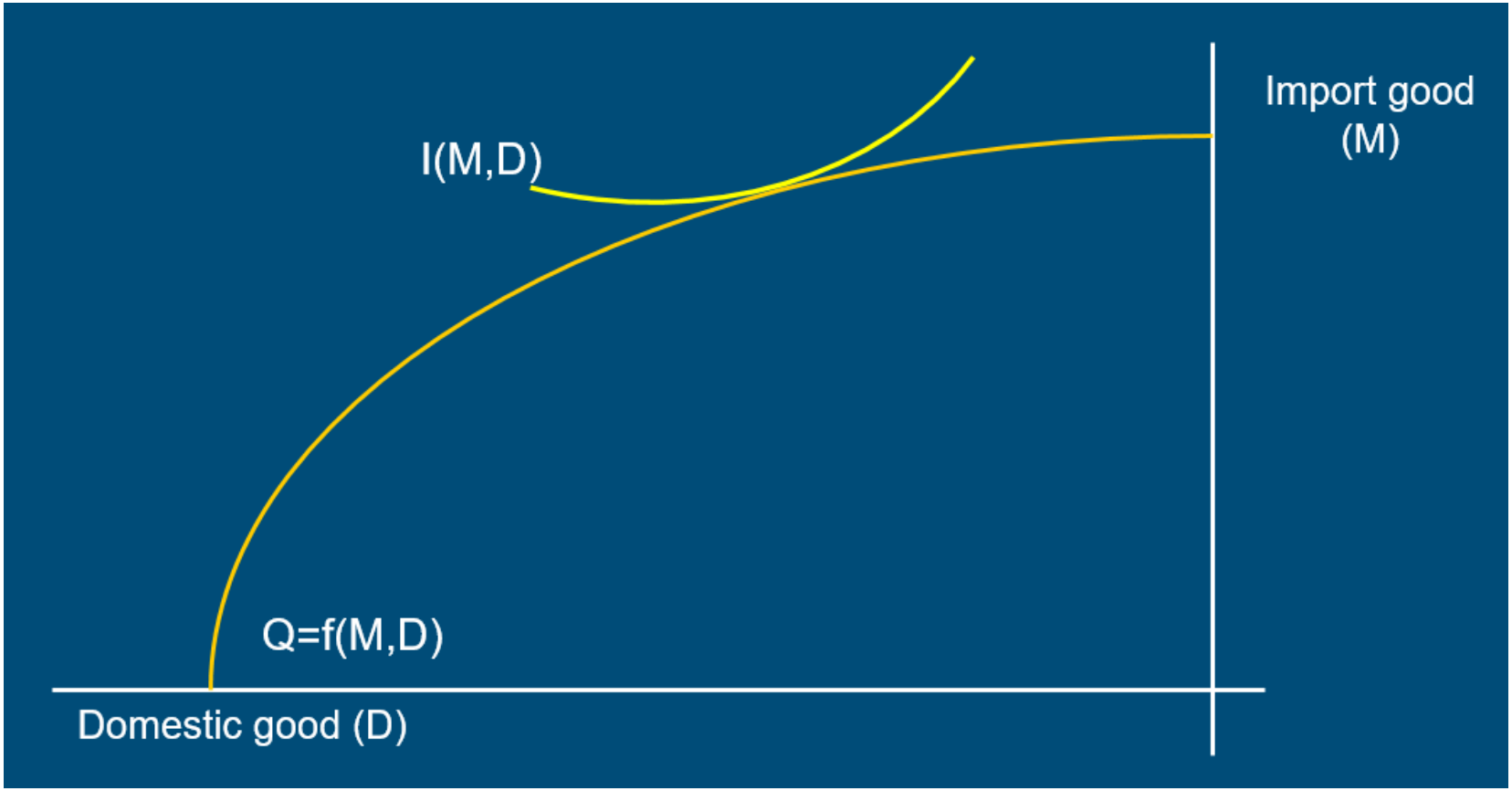
Supply Response in Excel



Demand Technology



Optimal Choice



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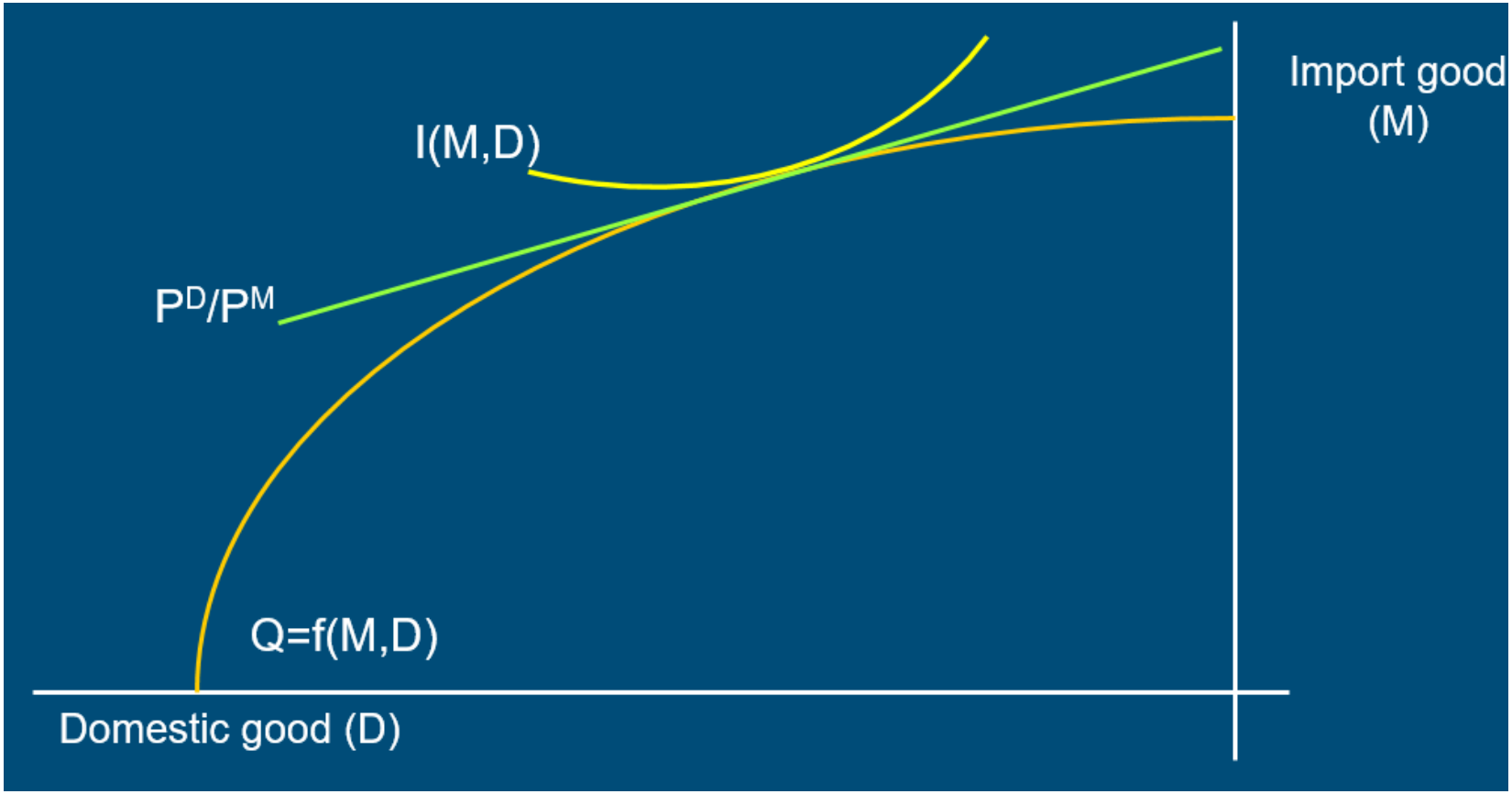
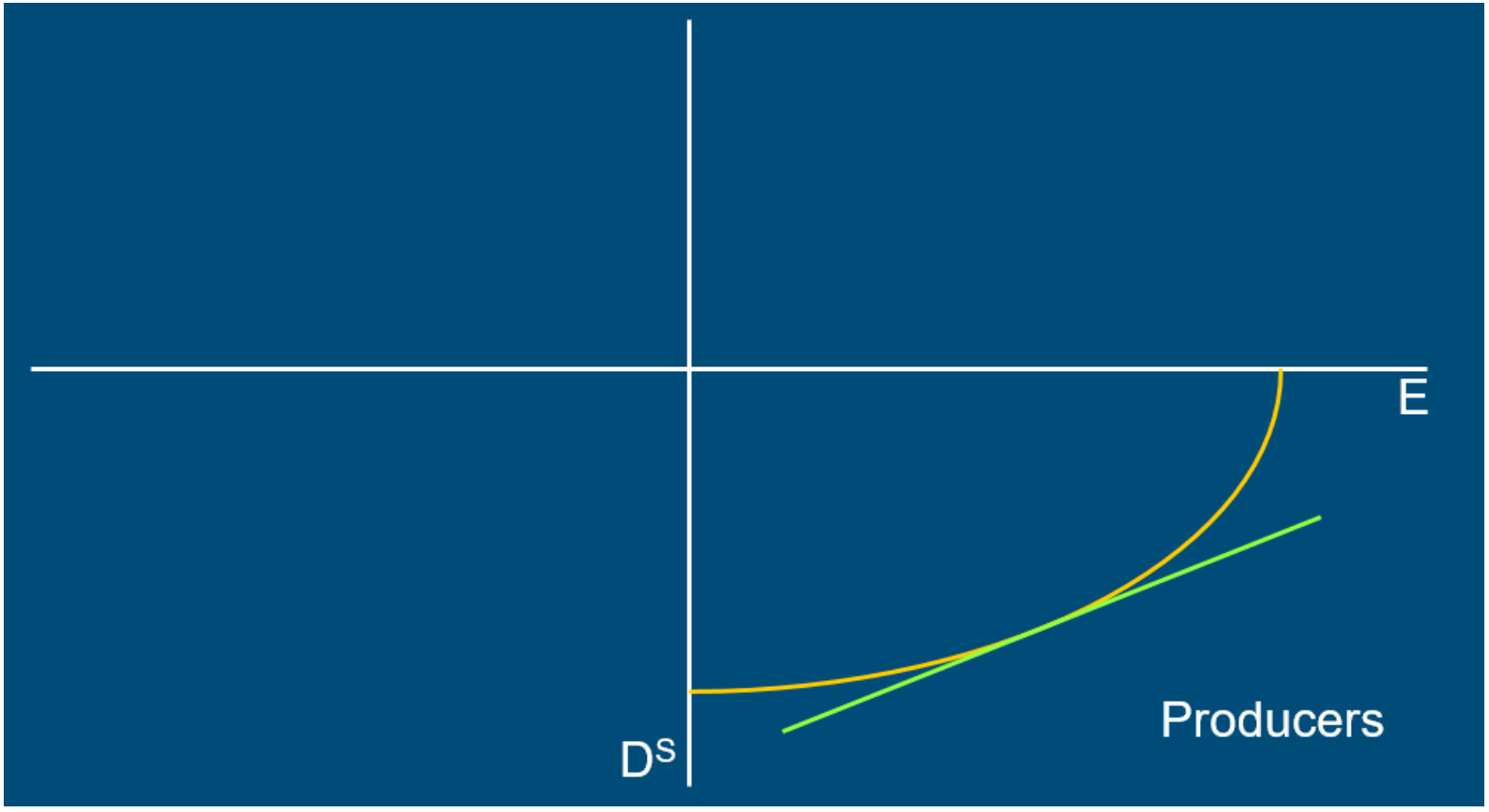


Linking Elements of the Model

1. Supply to the domestic market needs to equal demand for the non-traded domestic good (D) : $D^S = D^D$
2. Current account balance (value of imports = value of exports + current account deficit (exogenous)

Linking Supply and Demand



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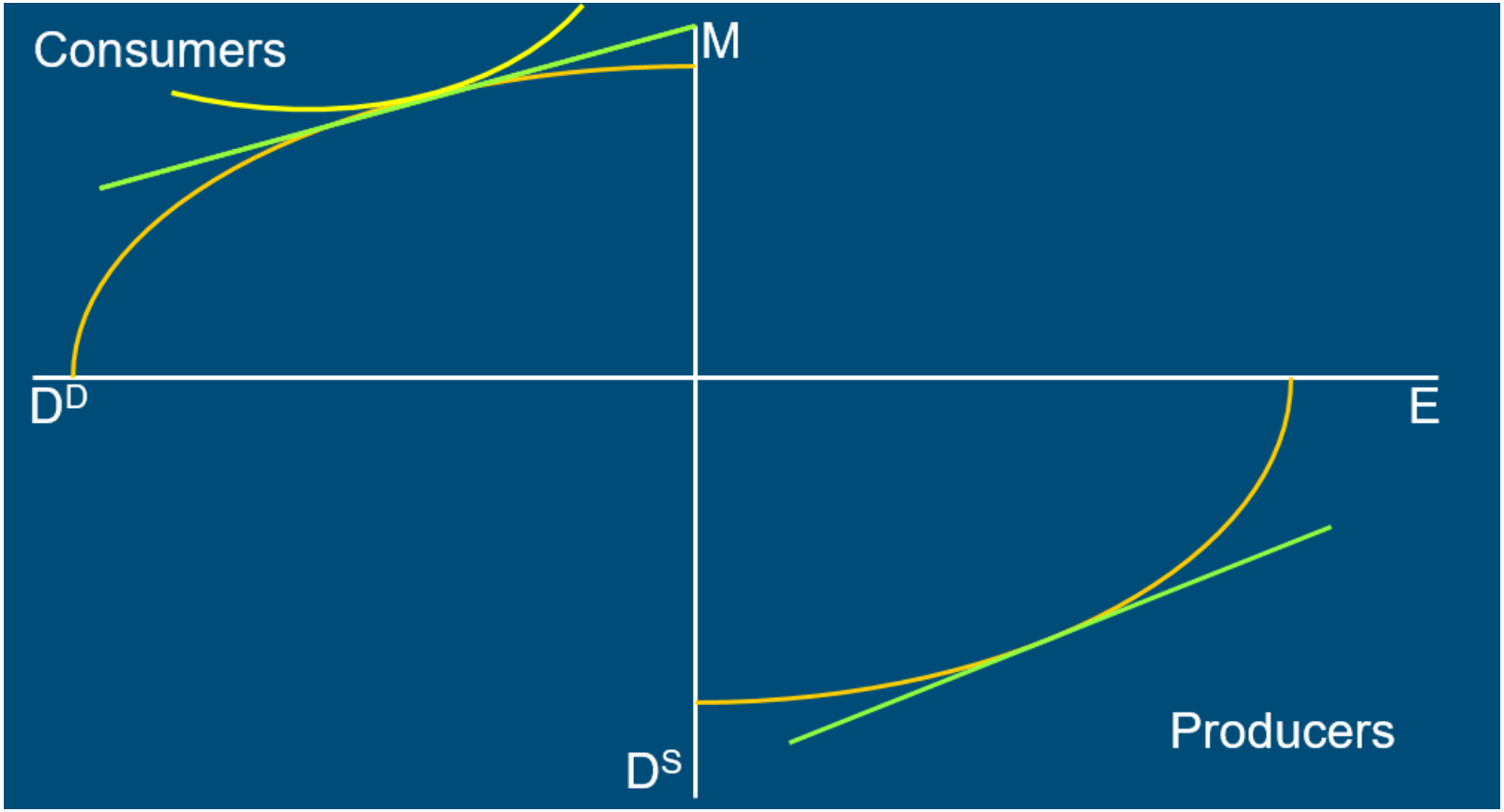

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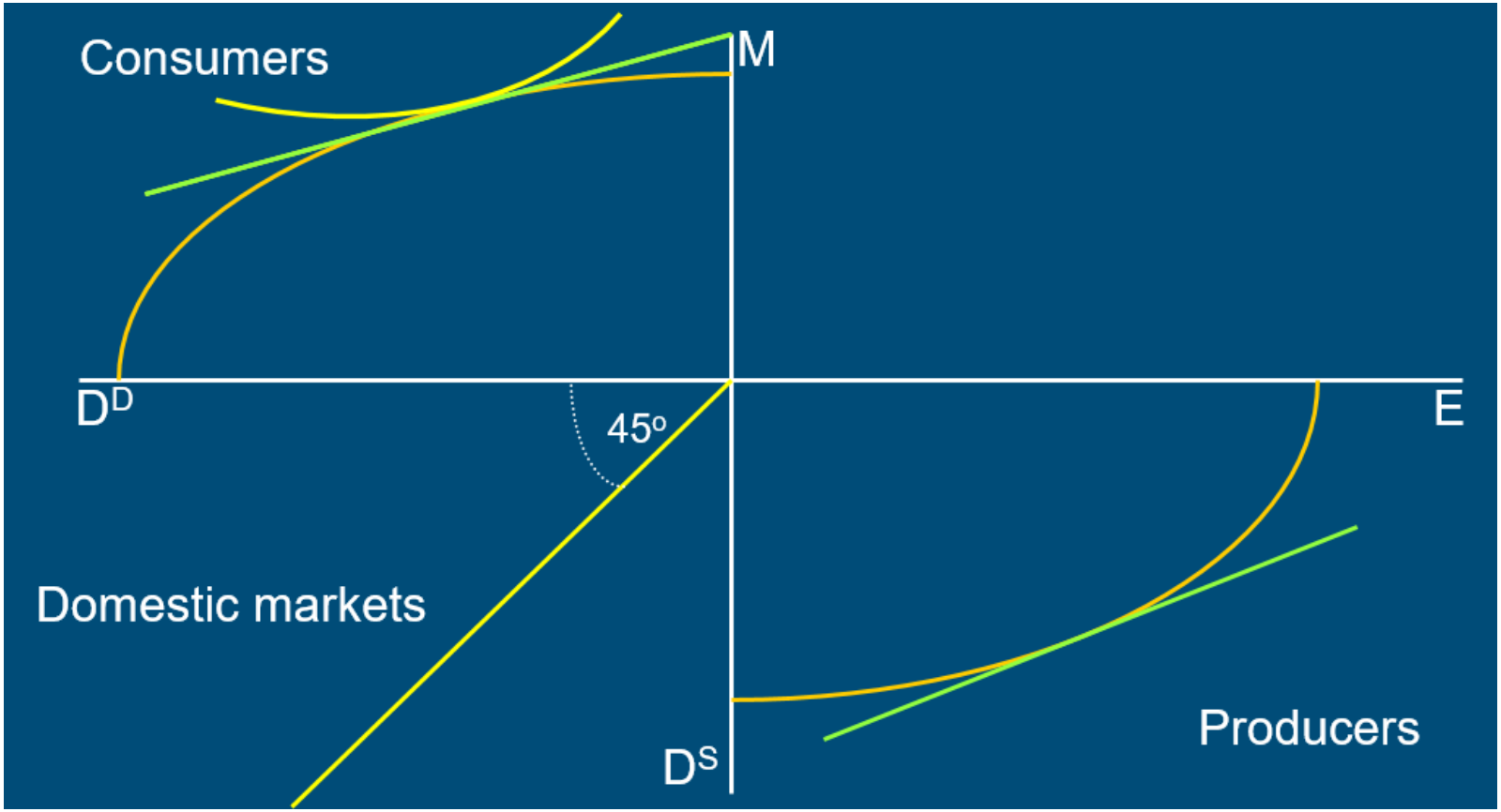
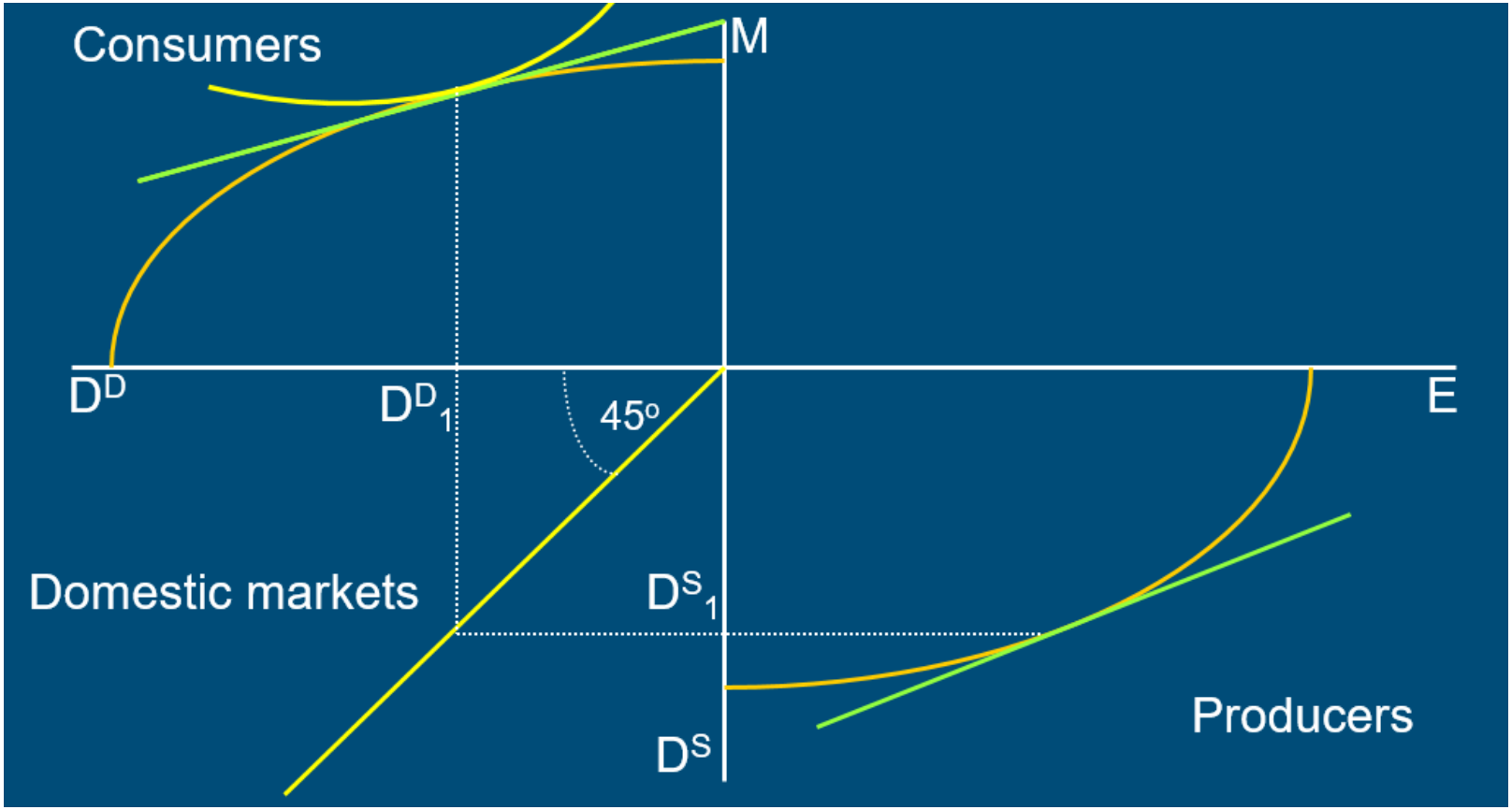


Trade Balance $\Rightarrow M = E$



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- Initially assume that B is zero (runs through origin) and that world market prices are unity (45^0 angle)

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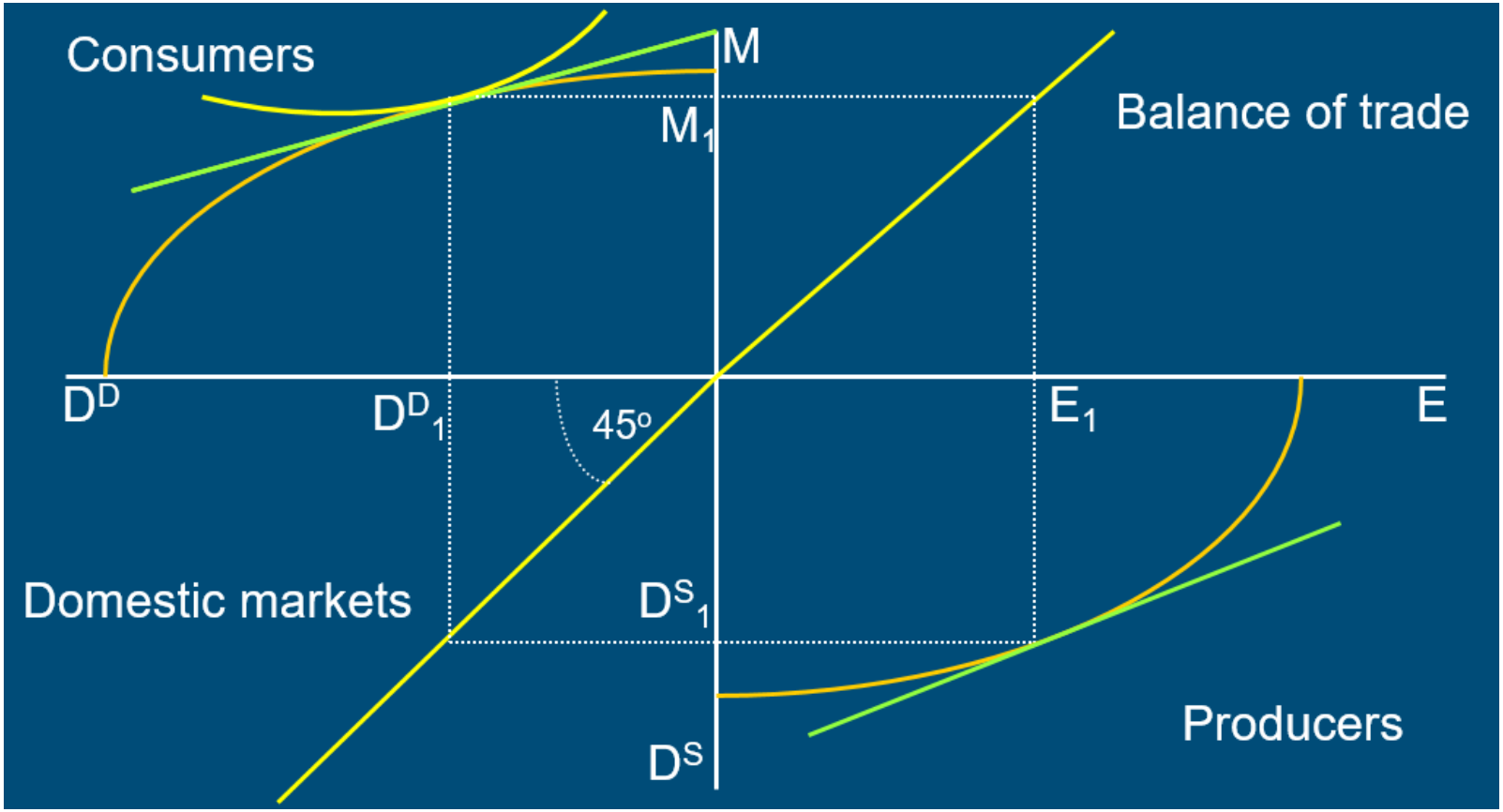
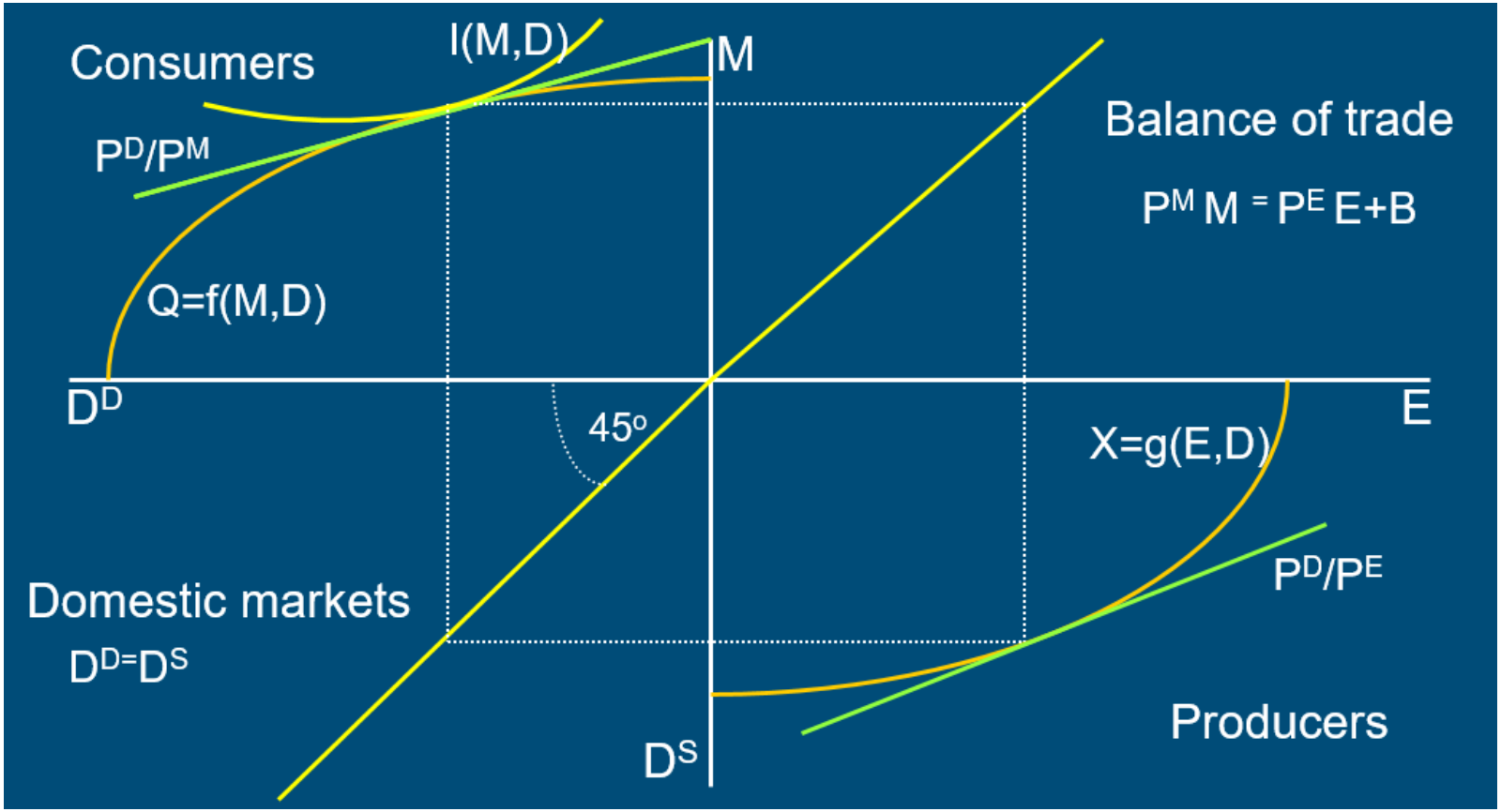


Basic General Equilibrium Model



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- Putting sector-effects in perspective
- Welfare analysis by including households

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