

# Will the Green Transition Be Inflationary? Expectations Matter\*



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*Keywords: Expectations, AS AD, Aggregate Prices, Climate Policy, Carbon Tax.*

*JEL codes: D84, E31, Q58.*

*While the literature on the effects of carbon taxes on output is rapidly growing, a clear understanding of the different channels through which a carbon tax affects prices is still missing. In this note, we analyze the effects of a gradual increase in the carbon tax in a simple two-period New Keynesian model. We find that the increase in the tax today gradually reduces emissions while exerting inflationary pressures. However, an expected further increase in the tax tomorrow depresses current demand, putting downward pressure on prices. We show that in our simple model if households anticipate a future fall in income the second effect is larger, while if they don't (because they are not rational or the government is not credible), the overall effect may be inflationary.*

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\*The opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the ECB, Banca d'Italia or the Eurosystem.

The goal of the Paris Agreement is limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. To comply with the treaty, countries need to reduce CO<sub>2</sub> emissions, which are the main source of global warming. For instance, the EU aims to be climate-neutral, i.e. having an economy with net-zero greenhouse gas emissions, by 2050.

Several theoretical models show that the green transition is costly in terms of GDP: the introduction of emission taxes or caps induces firms to reduce production and pay abatement costs (Diluiso et al. 2021; Ferrari Minesso and Pagliari, 2021; Ferrari and Nispi Landi, forthcoming). While the policy debate has widely discussed the risk of a potential increase in inflation triggered by the carbon tax<sup>1</sup> – so called *greenflation* – there are few theoretical studies of the impact of the green transition on inflation. Whether prices increase or decrease in response to environmental regulation is an important issue for policy makers in general and for central banks in particular, also given the recent inflationary wave around the world.

In Ferrari and Nispi Landi (2022), we analyze the response of inflation to carbon taxes in a simple microfounded two-period New Keynesian model, where CO<sub>2</sub> emissions are increasing in the final good's production and decreasing in firms' abatement spending. We interpret the first period as the short run, where prices are sticky and monetary policy has real effects; the second period is the long run, prices are flexible, and output is supply determined. We model the green transition as the introduction of a tax on emissions (a carbon tax) in the short run, which further increases in the long run. The revenues of the tax are transferred to households. Besides emissions and carbon taxes, the model is akin to Benigno (2015), which is a two-period version of the textbook New Keynesian model (Woodford, 2003; Gali, 2015).

In the short run, the model has a nice aggregate supply-aggregate demand representation (AS-AD, Figure 1). The AS line is a Phillips curve, where price level  $p$  is an increasing function of firm's marginal costs, which positively depends on output  $y$  and on the carbon tax (all these variables refer to the short run). The AD line is a Euler equation, where output is decreasing in the price level: other things equal, a higher short-run price level implies a lower expected future inflation, pushing up the real interest rate, thus depressing aggregate demand. Crucially, the AD line also implies that short-run output positively depends on long-run output, following a permanent-income argument: if households expect to be richer in the future, they increase current demand today.

The initial equilibrium lies in the origin of the axis (Figure 1). The government announces the new environmental plan, whereby carbon taxes gradually increase. The central bank sets the nominal interest rate following a Taylor rule. The short-run tax increase raises firms' marginal costs, driving prices up, other things equal: the AS line shifts upward (Figure 1, red dotted line). But other things are not equal. While the short-term emission tax does not shift the AD curve, a rise in the long-term tax reduces long-term output, moving the AD curve downward (Figure 1 blue dotted line): if households correctly foresee a lower future income they reduce current demand. Short-term output unambiguously falls, given the reduction in aggregate demand and aggregate supply (point E'). The short-term impact on prices is less obvious: while the increase in marginal costs yields positive supply-side price pressures, the decrease in future income yields negative demand-side price pressures. As far as long-term taxes are higher than short-term taxes, an assumption consistent with global plans to progressively tighten the emissions regulation, we find that the demand channel is stronger and therefore the price level goes down.

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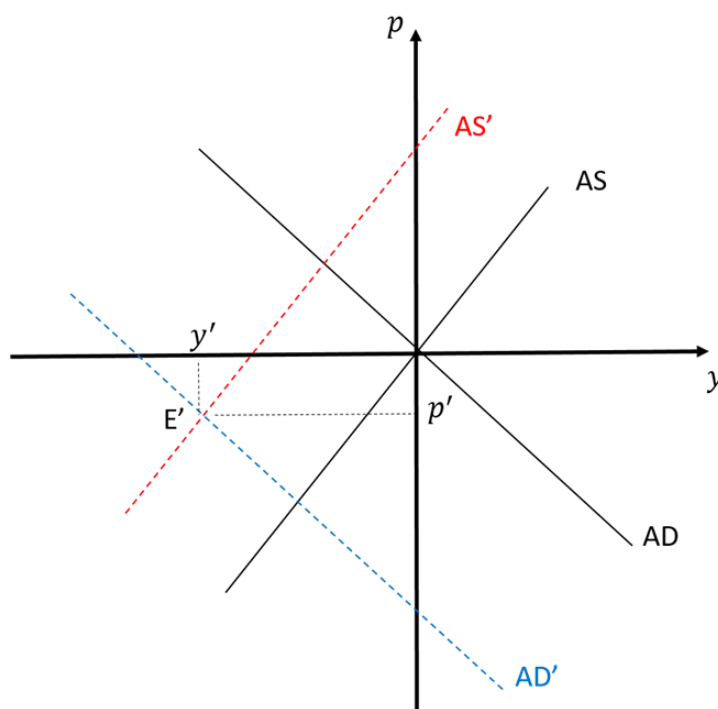
<sup>1</sup> See for example Pisani-Ferry (2021), Schnabel (2022), and Schnabel (2022b).

We extend the model along several lines, to challenge the robustness of our result. We show that introducing hand-to-mouth households, modeling two sectors (green and brown) rather than one, using a cap-and-trade policy instead of carbon taxes, or considering several assumptions on monetary policy do not change the results. Making total factor productivity (TFP) dependent on emissions could reverse the result, but only if the elasticity of TFP to emissions is much higher than the standard calibration found in the literature. In this latter case, the aggregate demand channel still dominates, but the logic is reversed: long-run output rises, boosting current demand, thus increasing current prices. We also show that our results hold in a larger model, with infinitely lived households and capital accumulation.

The crucial assumption for our results is that of perfect rationality/credibility of the government. If many households do not foresee the reduction in future output, either because they are boundedly rational and form their expectations in a backward-looking fashion or as they do not believe the government’s plan, aggregate demand does not fall enough and the supply channel is stronger: in this case the price level increases. Expectations matter, as the title of our article suggests.

Our model is purposely simple and we may have ignored some potentially relevant channels. For instance, we do not consider the role of innovation and R&D. The development of new green technologies, together with stringent regulation on emissions, can lead to a high rate of obsolescence of brown capital that would be convertible into capital for the green sector only to a limited extent. In this case, the demand for investments in the green sector could increase considerably, thus offsetting the negative impact of demand of the foreseen increase in taxes. Moreover, in our analysis long-term inflation expectations always remain anchored to the central bank objective. If the temporary period of inflation determined by imperfect credibility of future taxes induces a dis-anchoring, the transition can become inflationary both in the short and in the long-term. We leave this issue to future research.

Figure 1: An AS-AD representation



Short-run equilibrium in the consumption-good market. AS:  $p = \kappa (y + \psi\tau)$ . AD:  $y = \bar{y} - \sigma^{-1}[r - (\bar{p} - p)]$ .  $p$  is the price level;  $y$  is output;  $\tau$  and  $\bar{\tau}$  are the carbon taxes in the short and in the long run, respectively;  $\bar{y} = -\psi\bar{\tau}$  is long-run output;  $\{\kappa, \psi, \sigma\}$  are positive parameters;  $r$  is the nominal interest rate and  $\bar{p}$  is the long-run price level: these two variables are under the control of the central bank. ■

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