Business Cycles and Environmental Policy

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The last decade-and-a-half has demonstrated the importance of business cycle fluctuations in economic policy design. The risk of hysteresis effects and the inability of conventional stabilizing policy tools to accomplish their role have dominated the recent macroeconomic debate (Yellen 2016). The Great Recession resulted in the loss of 8.7 million jobs (about 7% of the total) and a 4.2% contraction of GDP in the United States. The current COVID recession may end up being even direr – 16 million jobs were lost in April 2020 alone. These severe economic outcomes, especially job losses, prompt demand for economic stimulus policy.

Recessions also affect the environment and potentially environmental policy. The COVID pandemic and lockdowns have reduced pollution substantially across the globe, even if only for a short time (Venter et al. 2020, Cicala et al. 2020, Le Quéré et al. 2020). Over the past several decades, carbon dioxide emissions have been significantly procyclical, increasing during expansions and declining during recessions (Doda 2014, Khan et al. 2019). What is the appropriate response of pollution policy to business cycles? Is there any role for pollution policy in reviving the economy while simultaneously addressing environmental externalities? For the most part, environmental policy has not included measures to respond to business cycles, though that doesn't mean that it shouldn't include them. Some policy tools have been proposed, for example an "emissions containment reserve" for the RGGI cap-and-trade program (Burtraw et al. 2017). The EU ETS cap-and-trade program has implemented a market stability reserve in part to address concerns over business cycles' effects on the market (Hepburn et al. 2016, Kollenberg and Taschini 2019). In March 2020 in response to COVID, the Trump administration exempted Toxics Release Inventory facilities from reporting requirements, which increased pollution (Persico and Johnson 2020) and likely exacerbated pollution's effects on COVID morbidity and mortality (Austin et al. 2020). Hence, there is a need to design instruments that incorporate, ex ante, features that can more efficiently regulate stringency during fluctuations in business cycles.

We propose an article that discusses the economic modeling of business cycles and environmental policy and distills how this literature can inform policymakers about how to tailor environmental policy in response to cycles. Following the academic and policy debate on

whether spending policies during recessions should try to orient the economy towards cleaner production, we also discuss the role of greening recovery plans and green deals during recessionary periods (Hepburn et al. 2020, Klenert et al. 2020). Finally, we analyze how environmental policy features that respond to business cycles can be implemented without leading to reductions in stringency.

The workhouse model in this literature is a dynamic stochastic general equilibrium (DSGE) model based on the real business cycle (RBC) model, where business cycles are fueled by random autocorrelated productivity shocks. Fischer and Springborn (2011), Heutel (2012), and Angelopoulos et al. (2013) are three early papers that modify the standard RBC model by including pollution and pollution policy. We present this basic model and discuss its interpretations and implications. Briefly, the model consists of an aggregate representative agent choosing consumption, labor, and investment to maximize total discounted utility. Capital evolves dynamically based on investment. Pollution arises from production and can negatively affect productivity, but the agent's choices can affect the level of pollution. Given a series of exogenous shocks to productivity, the model can be used to find the efficient level of investment and pollution that maximizes total discounted utility. The model can also analyze pollution policies, like pollution taxes or cap-and-trade.

Since those early papers, reviewed in Fischer and Heutel (2013), several extensions to the basic model have been considered studying the existence of complementarities or trade-offs among policy areas, and the role played by different distortions in shaping business cycles. Annicchiarico and Di Dio (2015) add new Keynesian elements to the model and explore the role of price rigidities and monetary policy. Dissou and Karnizova (2016) extend the model to consider multiple sectors and sector-specific shocks. Annicchiarico and Di Dio (2017) consider the interaction between environmental policy and monetary policy, including second-best policy combinations. Gibson and Heutel (2020) include a search-and-matching model of the labor market that generates unemployment, and Carattini et al. (2020) add a financial sector with frictions and macroprudential policy tools. Diluiso et al. (2020) study the transition toward a low-carbon economy at business cycle frequency, exploring the role for financial regulation and "green" credit policy as additional tools to address pollution and mitigate transition risk.

We will discuss the main findings relevant to policymakers from this literature, summarized as follows. First, policy design can have important effects on the volatility of

outcomes. An emissions cap leads to lower volatility than does an emissions tax. Second, dynamically-optimal policies can increase welfare. Generally, the literature finds that efficient pollution taxes are procyclical in response to productivity shocks, increasing during expansions and decreasing during recessions. Since adjusting policies ex post may be difficult, incorporating complementary mechanisms (price corridors or quantity-based triggers) that can better approximate an efficient adjustment can increase welfare. Third, however, the source of the shock can affect the cyclicality of efficient policy. An environmental shock can yield counter-cyclical efficient policy, in contrast to a productivity shock. Fourth, the interaction between pollution policy and other policies, including monetary policy, macroprudential policy, and labor market policies, can have important implications for policy design. Ignoring other distortions or pre-existing policies can lead to inefficiencies.

Finally, we will address several outstanding policy-relevant questions that remain to be answered. First, these studies are primarily about efficiency, and relatively little is known about the distribution of impacts of efficient cyclical policies or equity considerations. Gibson and Heutel (2020) show that the efficient policy response to pollution and labor market frictions may be less equitable than a second-best policy, over-burdening workers and under-burdening firms. Second, except for Dissou and Karnizova (2016), these studies are based on an aggregate, representative agent model, so little is known about how heterogeneity across sectors, or consumers, or geographies may impact policy design. Third, most of these studies focus on business cycles fueled by productivity shocks, and so the effects of other types of shocks (e.g. demand shocks, monetary policy shocks, financial shocks) are less well-understood. Fourth, the interaction between environmental policies and many other types of policies have yet to be studied, including stimulus policies or other taxes. Fifth, most studies assume that environmental policy stringency is optimal and analyze optimal responses to business cycles. In many environmental realms, policy stringency is below efficient levels, raising questions about the appropriate response to productivity shocks. Sixth, transition risks, or the potential costs of moving towards the long-run efficient policy path, and physical risks related to climate shocks, need to be addressed in the context of business cycle models.

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