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Trade openness and the Phillips curve: The neglected heterogeneity and robustness of empirical evidence

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ABSTRACT

A cross-country parameter homogeneity assumption is usually imposed in the literature to test the effect of trade openness on the slope of the Phillips curve. A conclusion from this literature is that trade openness has no significant effect in advanced industrial countries. In this paper, we argue that the validity of the parameter homogeneity assumption is not guaranteed from a theoretical perspective, and we find that this assumption is not valid for advanced industrial countries. Trade openness has significant effects on the slope of the Phillips curve in several industrial countries but the signs of the effects vary across countries.

1. Introduction

Due to differences in modeling strategies and behavioral assumptions, previous theoretical models on the trade openness-Phillips curve correlation give different predictions on the effect of trade openness on the slope of the Phillips curve. Models of Romer (1993) and Lane (1997) predict that an increase in trade openness steepens the Phillips curve, while models of Razin and Loungani (2005) and Daniels and VanHoose (2006) predict that an increase in trade openness flattens the Phillips curve. As a consequence, previous cross-country empirical studies (Badinger, 2009; Daniels, Nourzad, & Vanhoose, 2005; Daniels & VanHoose, 2009; Temple, 2002) use the sign and statistical significance of estimated trade openness-Phillips curve correlation to test the empirical relevance of various theoretical models. In those cross-country studies, parameters of the regression equation are assumed to be homogeneous across countries. Other authors (Ball, 2006; Ihrig, Kamin, Lindner, & Marquez, 2010; IMF, 2006) who use panel data methods to test the trade openness-Phillips curve correlation make the the same assumption. With the parameter homogeneity assumption, those studies find that trade openness has no significant impact on the slope of the Phillips curve in industrial countries.

However, a recent theoretical study by Sbordone (2007) finds that the net effect of a change in the degree of trade openness on the slope of the Phillips curve is ambiguous, depending on the relative changes in the steady-state price elasticity of demand, elasticity of the representative firm's desired markup to its market share, elasticity of the firm's marginal cost to its own output after a change in trade openness. The net effects of trade openness on the slope of the Phillips curve will differ in size and/or sign

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across countries if those relative changes after a change in trade openness differ across countries, which implies that a parameter homogeneity restriction in the econometric analysis is potentially problematic.

In this paper, we test the parameter homogeneity assumption in a panel data setting. Our results show that the parameter homogeneity assumption does not hold. Allowing parameters to be heterogeneous across countries, we find that trade openness has significant impacts on the slope of the Phillips curve in several major industrial countries (Canada, France, Italy, Sweden and the United States), but the impacts vary in sign across countries.

The paper proceeds as follows. Section 2 introduces the empirical model and the data. Section 3 tests the parameter homogeneity assumption in a panel data setting. Section 4 studies the slope of the Phillips curve in the sample countries using country-specific time series analysis. Section 5 concludes.

2. The empirical model and data description

As surveyed by Gordon (2011), there is a debate on the empirical modeling of inflation expectations. Some economists assume that agents are backward-looking while others use a forward-looking assumption. We adopt the backward-looking assumption because the estimation of the forward-looking model involves instrumental variables and the results are subject to weak instrument problems (Kleibergen & Mavroeidis, 2009; Nason & Smith, 2008). The focus of this paper is on the validity of the parameter homogeneity assumption in the previous empirical models. Hence, it is better to separate the focus issue from the instrument quality issue. Moreover, previous studies (Ball, 2006; Ihrig et al., 2010; IMF, 2006) on the openness-Phillips curve correlation typically adopt the backward-looking assumption. Therefore, it is easier to compare the results if we use the same assumption. More specifically, our econometric analysis is based on the following backward-looking Phillips curve model:

$$\pi^c_{i,t} = \delta_{0i} + \delta_{1i}\pi^c_{i,t-1} + \delta_{2i}\hat{y}_{i,t} + \delta_{3i}\alpha_{i,t}\hat{y}_{i,t} + \tau'_{i1}X_{i,t} + \tau'_{2i}W_{i,t} + \varepsilon_{it}, \tag{1}$$

where i is the index for country $i=1,\ldots,N$, $t=1,\ldots,T$ is the index for time, $\pi^c_{i,t}$ is the core consumer price index (CPI) inflation rate; $\alpha_{i,t}$ is the trade openness measured as total imports and exports divided by GDP; $\hat{y}_{i,t}$ is the output gap; δ_{0i}, δ_{1i}, δ_{2i} and δ_{3i} are parameters; τ_{i1} and τ_{i2} are vectors of parameters; the vector $X_{i,t}$ contains the cost-push terms, $W_{i,t}$ contains the control variables and ε_t is the error term.

We consider three cost push terms, p^e_{it},p^f_{it},p^m_{it}, which are the deviations of energy, food, import price changes from the last-period core CPI inflation rate, respectively. Following Ihrig et al. (2010), we also add the interaction term $p^m_{it} * Mshare_{it}$ as an additional indicator for the cost push. $Mshare_t$ is import as a share of GDP. There is also debate on whether or not one should include the cost push terms into the empirical model. Ball (2006) argues that those terms should not be included in the Phillips curve estimation. This argument is rooted in the theoretical model of Ball and Mankiw (1995) in which smooth relative price changes, such as smooth changes in the price of energy, food and import goods relative to the general price level, do not affect the general price level. The empirical validity of that model, however, is challenged by Bryan and Cecchetti (1999). Gordon (2011) justifies the role of relative price changes by price rigidity in sectors which are not subject to the relative price shocks. Monacelli (2005) suggests that in an open economy with incomplete exchange rate pass-through, additional cost-push terms must be added to the Phillips curve if the output gap is used to measure the log deviation of real marginal cost. Batini, Jackson, and Nickell (2005) suggest that the signs of the cost-push terms in the Phillips curve can be either positive or negative, depending on the elasticity of material inputs with respect to gross output. Due to the theoretical ambiguity, we do not impose any sign or size restriction on the cost-push terms and will apply the general-to-specific model selection strategy to eliminate redundant variables when estimating the slope of the Phillips curve.

Our set of control variables include financial openness*output gap, log GDP*output gap, log population*output gap, trend inflation*output gap and global inflation. Theoretical models of Loungani, Razin, and Yuen (2001); Razin and Yuen (2002), and Razin and Loungani (2005) suggest that besides trade openness, financial openness could also affect the slope of the Phillips curve. Badinger (2009) shows that omitting the interaction between the degree of financial openness and the output gap in the regression can cause an endogeneity problem. More specifically, trade and financial openness are highly correlated. If both have significant effects on the slope of the Phillips curve, omitting one of them will cause an omitted variable bias.

Previous literature, for example, Lane (1997), argues that country size could affect the slope of the Phillips curve. Because openness is correlated to country size (Lane, 1997), omitting country size could lead to an estimation bias. While Lane (1997) uses a country's GDP as a proxy for the country size, Badinger (2009) uses population as an alternative proxy. We use both as candidate proxies for the country size and use the general-to-specific model selection strategy to decide whether those control variables should stay in the model. The state-dependent pricing model of Bakhshi, Khan, and Rudolf (2007)) suggests that trend inflation affects the slope of the Phillips curve. An early empirical study of Ball, Mankiw, and Romer (1988) made a similar argument. Therefore, we follow them to control for the impact of trend inflation (which is measured as the HP-filtered trend of core inflation rate). Our last control variable is the "global inflation" variable defined by Ciccarelli and Mojon (2010). These authors find that there is a common factor in the OECD countries' national inflation rates and they call this common factor "global inflation". Ciccarelli and Mojon (2010) suggest that a simple cross-country average of 22 OECD countries[1] fits the "global inflation" well, so we follow them and proxy global inflation by the simple cross-country average of the 22 OECD countries.

[1] The 22 OECD countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, New Zealand, Norway, Portugal, Sweden, Switzerland, Spain, United Kingdom, United States, and the Netherlands.