Reviewing demand regimes in open economies with Penn World Table data

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This paper uses the Penn World Table dataset to examine capacity utilization response to exogenous changes in the wage share in six developed countries from 1960 to 2019. Instead of assuming that the mean and volatility of variables are constant over time, our vector autoregression model allows regression coefficients and volatilities to be time-varying in nature. With an exploratory character, a rolling window of thirty years shows that the conditional mean of capacity utilization in response to the wage share and the real exchange rate changes is unstable over time. We reached three main conclusions. First, in all six sample countries (U.S., U.K., France, Sweden, Austria, and the Netherlands), a 1-standard deviation shock to the wage share generates transient, significant, and negative impacts on capacity utilization that fades away at most in two years. Further, only in the U.S. and Sweden, the response of capacity utilization to 1-standard deviation shock to the real exchange rate is significant and positive, being more persistent in the latter. For the other four countries, unanticipated changes in real exchange rates do not influence output. Lastly, the response of wage share to 1-standard deviation shock to the capacity utilization is positive and significant only in the U.K., Sweden, and Austria. The effect tends to disappear in 3 to 4 years. In the U.S. economy, France, and the Netherlands, we have found no evidence of the labor share in income responding to unanticipated changes in capacity utilization. All these analyses account explicitly for endogenous labor productivity growth. Thus, these findings are invariant to changes across countries in this variable, at least in the short run.

Keywords: wage-led demand; profit-led demand; income distribution; vector autoregression; time-varying parameters; stochastic volatility.
JEL Classification: D3; C32; E25.

Este estudo emprega dados anuais da Penn World Table 10 para analisar a resposta da utilização da capacidade a variações exógenas na parcela dos salários em seis países de alta renda no período de 1960 a 2019. A metodologia empregada baseia-se na aplicação de um vetor autorregressivo em que tanto os coeficientes quantos as variâncias dos termos de erro variam livremente ao longo do tempo, assim como a função impulso resposta. Uma janela móvel de 30 anos gerada através de análise de regressão foi utilizada, de forma exploratória, para indicar se os coeficientes são instáveis ao longo do tempo. A análise das funções impulso resposta permitiu a obtenção de três conclusões. Primeiro, em todos os seis países (Estados Unidos, Inglaterra, França, Suécia, Áustria e Holanda) a resposta da utilização da capacidade ao choque

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de um desvio padrão sobre a parcela dos salários é negativa, significativa, e extingue-se em até dois anos. Segundo, apenas nos Estados Unidos e Suécia observa-se resposta positiva, significativa e persistente da utilização da capacidade em relação a alterações não antecipadas na taxa de câmbio real. Nos demais países, o produto não responde significativamente a alterações exógenas na competitividade. Finalmente, observa-se resposta positiva e significativa da parcela dos salários ao choque de um desvio padrão sobre a utilização da capacidade apenas na Inglaterra, Suécia e Áustria. Nos demais países não encontramos evidência de que alterações exógenas no nível de atividade sejam capazes de produzir alterações positivas e significativas na parcela dos salários. Todas as análises levam em conta explicitamente o crescimento da produtividade do trabalho em ambiente de economia aberta.

Keywords: utilização da capacidade; distribuição funcional da renda; vetor autorregressivo; coeficientes e volatilidades variando no tempo.
Classificação JEL: D3; C32; E25.

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1 Introduction

This paper aims to study capacity utilization response to exogenous changes in the wage share in six high-income countries from 1960 to 2019 using Penn World Table (PWT) data. The PWT dataset is a reliable and homogeneous source of real GDP and relative prices comparison over time and across countries in a standardized way (Feenstra et al., 2015). The theoretical models analyzing demand regimes introduced by Blecker (1989; 2011), Bhaduri and Marglin (1990), and more recently, Sasaki et al. (2013) emphasize open economy relationships.[1]

In these theoretical models, the markup, price strategy of firms, and workers' bargaining power depend on international competition, mainly international competitiveness, as expressed by the real exchange rate. With opening to trade and greater economic integration, just as firms have to consider international competition when setting their prices, it is reasonable to suppose that workers have to make similar considerations when bargaining wages. Indeed, as noted by Hutchinson and Persyn (2012), firms have become more and more footloose and may transfer their production to foreign countries seeking cheaper labor.[2]

Nonetheless, most empirical works that seek characterizing demand regimes lack open economy variables and international competitiveness in their analysis. The present paper complements the study of Basu and Gautham (2019), examining the impact of an exogenous change on the wage share in an open economy environment. We also investigate whether exogenous changes in competitiveness and demand may significantly affect other macro variables in a group of high-income countries.

Figure 1 displays annual *variations* in the cyclical components of the wage share, capacity utilization, labor productivity, and real exchange rate in the U.S. in 1963-2019. The noteworthy feature of Figure 1 is that the sign of the relationship between the cyclical components of wage share, capacity utilization, and competitiveness undergo substantial changes in different periods.

[1] Lima and Porcile (2013) study the influence of heterogeneous preferences on the real exchange rate through a model in which capacity utilization and growth depend upon the codetermination between the real exchange rate and income distribution in an open economy.

[2] Altomonte and Barattieri (2015) provide empirical evidence of markup's endogeneity using data from 28,000 manufacturing firms and present a literature survey on this topic. Gonzalez-Garcia and Yang (2020) present empirical evidence that greater trade liberalization and trade integration are associated with a significant decline of firm's markup in 83 emerging market economies and developing countries. For the evolution of markups based on firm-level data for the US economy since 1950, see De Loecker and Eeckhout (2017). De Loecker and Eeckhout (2018) document the evolution of global market power using data from 70,000 firms in 134 countries and their implications for labor income share changes worldwide.

Visual inspection suggests that in the 1970s and 1980s, capacity utilization and competitiveness move together. While after the 1990s, these variables move inversely with one another. Differently, capacity utilization seems to correlate negatively with the wage share in the 1970s and 1980s and comove together after the 1990s. Thus, capacity utilization response to real exchange rate and wage share changes hardly can be considered constant over decades.

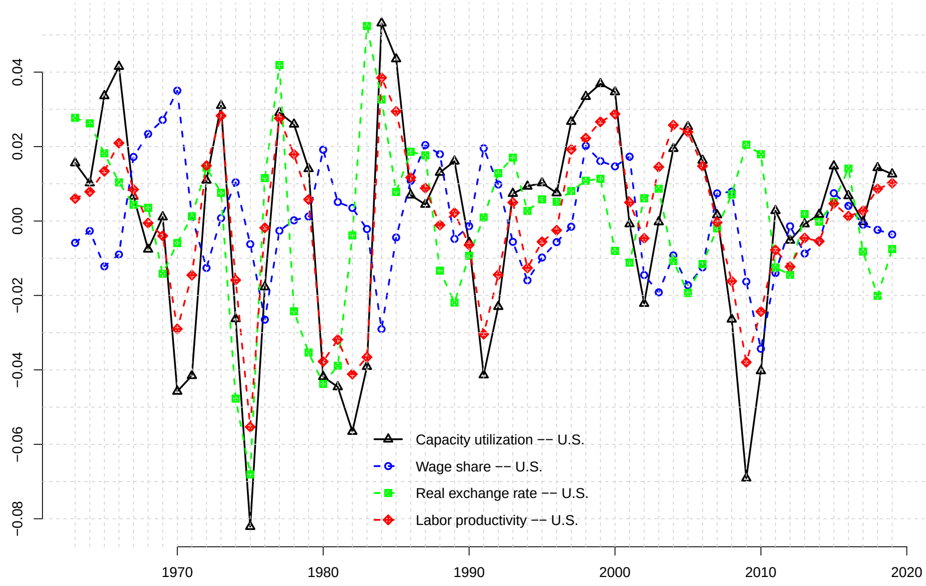

Fig. 1 – This figure displays joint movements of the cyclical components of the capacity utilization (black, z_t), wage share (blue, ψ_t), labor productivity (red, x_t) measured by the ratio between real GDP and average annual hours worked by persons engaged, and the real exchange rate (green, q_t) in the U.S. from 1963 to 2019. In the 1970s and 1980s, we observe a clear positive correlation between real exchange rate and capacity utilization: whenever the real exchange rate rises (a real depreciation, increased competitiveness of domestic goods), economic activity rises afterward. Nevertheless, after 1990 we observe the opposed movement, and the wage share varies closer to the other series than before. Moreover, the correlation between labor productivity growth and the wage share also suffers abrupt changes over time. From this picture, it seems clear that the functional distribution of income, economic activity, labor productivity, and competitiveness are part of a system of interrelated (endogenous) variables.

We contribute to this literature in three ways. First, instead of assuming that the mean and volatility of variables are constant over time, our vector autoregression (VAR) model allows regression coefficients and variance of the error terms to vary freely in time. We adopt the suggestion of Blecker (2011), allowing for structural breaks and time-varying parameters that remain the principal drawback in this field for longer time horizons.

Second, concerning Basu and Gautham (2019), we use a greater span of data and a larger sample of countries, ranging from 1960 to 2019, without restricting the coefficients and model variances to be fixed over time. Third, our dataset has become available very recently and allows international comparison in a fully standardized way. Moreover, because the impulse response functions are also a function of the Bayesian VAR parameters, it implies that our impulse response functions are all *time*-dependent. Despite being a more flexible one, our approach is similar in spirit to Ferraresi et al. (2015), in which the impulse response functions are *regime*-dependent.

We summarize below existing empirical studies that seek to characterize demand regimes in countries by focusing only on papers that adopt the aggregative approach (Blecker, 2016), employing data that only describe short-run relationships since our paper centers only on the study of cyclical fluctuations of economic activity and distribution. In this category of studies, most of the papers use VAR (Vector Autoregressions) models or instrumental variables estimator to deal with the simultaneity of the involved variables. Using quarterly data from 1948 to 2009, Nikiforos and Foley (2012) empirically identify a state-dependent relationship between capacity utilization and the wage share in the U.S. They employ two-stage least squares and concluded that a profit-led demand regime characterizes the U.S. economy in which a rise in the wage share significantly reduces capacity utilization. Employing a five variable VAR model to the U.K., U.S., and France, over the period 1970 to 1997, Stockhammer and Onaran (2004) have found that income distribution has little effect on capacity utilization or employment.

By adopting a bivariate VAR and using data from 1948 to 2002, Barbosa-Filho and Taylor (2006) also conclude that demand is profit-led in the U.S. economy. Carvalho and Rezai (2016) employ U.S. annual data from 1967 to 2010 using a threshold bivariate VAR model to describe potential nonlinear relationships between capacity utilization and income distribution. Using Cholesky factorization, they conclude that demand in the U.S. is profit-led, and the personal inequality of income may interfere in this relationship.

Basu and Gautham (2019) recently reexamine the topic of the summarized papers, highlight the importance of including open economy relationships into the analysis, e.g., endogenous labor productivity growth and the real exchange rate, and take more care about identification issues using VAR methods. Basu and Gautham (2019) use U.S. quarterly data from 1973 to 2018 and adopt a VAR model with a sound theoretical identification strategy. They confirm the previous result to the U.S., in which a profit-led demand regime predominates.

In this paper, we build on the work of Basu and Gautham (2019) using the same identification strategy to complement the analysis by expanding the sample countries to include five other economies beyond the United States and including open economy variables into the analysis, without restricting the coefficients and volatilities of the VAR model to be fixed over time. Furthermore, we can extract reliable conclusions valid for open economies because we use a standardized dataset for international comparison by design (Feenstra et al., 2015).

Because of the dual character of the real wage as cost and demand, the main channel by which an unanticipated change in wage share affects capacity utilization seems to depend on which effect is predominant in the particular economy. An exogenous increase in the wage share may boost consumption and economic activity, but it also can depress competitiveness in an open economy by decreasing net exports. Moreover, in a model with explicit feedback between goods and labor markets, Sasaki et al. (2013) show that the nature of the output response to wage share changes may depend not only on the demand regime in operation but also on which agents bear more of the burden originating from international competition.

Theoretically, Blecker (2016) argues that although an increase in the wage share may increase consumption in the long run, an adverse effect on the capacity utilization of such an increase is more likely to exist in the short run because higher labor costs may impair the international price competitiveness of the country. Because we are using data describing only short-run cyclical movements, we expect from the outset that an exogenous change in the wage share is more likely to imply a negative impact on the capacity utilization through cost effects in an open economy environment. Nonetheless, in spite of this limitation, our methods and data allow us to study complementary questions of great interest in actual policy circles and discussions, making some modest improvements when compared to previous studies.

The purpose of this short paper is empirical, and we refrain from presenting the well-known demand regime model for open economies (see, for example, Blecker 1989; 2011; Bhaduri and Marglin 1990; Sasaki et al. 2013). The remainder of this paper is organized as follows. Section 2 briefly describes the methodology and the Bayesian VAR with time-varying coefficients and stochastic volatility used in the estimations. Section 3 reports the empirical results and discusses the main findings. Finally, section 4 concludes the paper.

2 Methodology

2.1 Econometric methodology

The Bayesian VAR with time-varying coefficients and stochastic volatility is suitable for characterizing demand regimes in open economies. It can describe nonlinearities and nonnormality in data beyond other features that are not well accounted for in the traditional VAR model. For example, unemployment tends to rise much faster at the start of a recession than it declines in a recovery. In addition, exchange rates exhibit occasional episodes in which volatilities rise considerably. The BVAR with time-varying coefficients and stochastic volatility may capture outliers, fat-tails in the distribution of the errors, approximate regime-switching patterns, and structural changes in parameters. The Bayesian VAR also is immune to the over-parameterization problem (*overfitting*) typically faced by classic VAR based on the OLS estimator, leading to inefficient estimates (Ciccarelli and Rebucci, 2003). Consider the time-varying VAR with stochastic volatility of Primiceri (2005) given by:

$$y_t = c_t + B_{1,t} y_{t-1} + \ldots + B_{k,t} y_{t-k} + A_t^{-1} \Sigma_t \varepsilon_t \tag{1}$$

where y_t is an 4 x 1 vector of endogenous variables; c_t is a vector of time-varying intercepts; $B_{i,t}$, $i = 1, \ldots, k$, are matrices of time-varying coefficients; A_t is a lower triangular matrix with ones on the main diagonal and time-varying coefficients below it. Σ_t is a diagonal matrix of time-varying standard deviations; ε_t is a vector of unobservable shocks with variance equal to the identity matrix. All the regression coefficients and variance parameters are allowed to evolve as random walks. All the innovations in the model are jointly normally distributed, with mean equal to zero and covariance matrix equal to V that is block diagonal. Primiceri (2005) describes the V matrix in detail.

The special feature of this VAR model relies on that the intercept c_t, as well as the coefficient matrices $\{B_{j,t}\}_{j=1}^{k}$, may freely change over time. Further, the composite error term $A_t^{-1}\Sigma_t\varepsilon_t$ implies that the residual variance-covariance matrix is permitted to vary over time as well. Both features of the VAR model are sufficient to describe parameters instability and time-varying volatilities of shocks that may affect the economy.

2.2 Priors

The estimation process requires using the Markov Chain Monte Carlo (MCMC) algorithm for numerical integration (Gibbs sampler). Ciccarelli and Rebucci (2003) describe the Bayesian estimation principle and the Gibbs sampler in a valuable and intuitive way. We use the default set of priors following precisely the suggestions made by Primiceri (2005, Section 3.1). Departing from default values stands the length of the training sample used to determine prior parameters via least squares (LS): we use the $\tau = 20$, which means we use 20 years of data to initialize. We included four variables and one lag for the estimation. This choice seems reasonable since using higher frequency data (quarterly), Primiceri (2005) uses only two lags for estimation.

In contrast to the classic VAR model, one advantage of the BVAR model when it allows the autoregressive coefficients to be random walks is that it implies very few parameters to be estimated. This feature of the BVAR also represents an additional advantage over classic VAR because determining the variables' integration order is usually another source of uncertainty. We use 50000 MCMC draws, excluding 5000 burn-in. The excluded draws do not enter into the calculation of posterior distributions. The magnitude of the shock (impulse) corresponds to one standard deviation of the error term.

2.3 Identification

The algorithm used to compute the recursive VAR model of Basu and Gautham (2019) is equivalent to the algorithm used to compute the reduced VAR model applying the Cholesky factorization of the reduced form covariance matrix (Stock and Watson, 2001, p. 103; Lütkepohl, 1991). In both methods, the order of variables matters to interpret the results. Thus, because we use the same order of variables and Cholesky factorization at *each point in time*, our reduced Bayesian VAR model corresponds precisely to the recursive VAR model of Basu and Gautham (2019) based on constant coefficients and variances assumption. [3]

Identification of the source of shocks in a VAR continues to be challenging in empirical studies because it "cannot be solved by a purely statistical tool" and "economic theory is required to solve the identification" (Stock and Watson, 2001, p. 102; Kilian, 2013; Sims, 1986). In particular, Sims (1986) suggests identifying the VAR model by imposing economically plausible restrictions on the contemporaneous interactions among macroeconomic variables. Kilian (2013) has made the same recommendation. Stock and Watson (2001) argue against using the recursive or reduced VAR model even when the identifying restrictions are based on economic theory. Instead, they recommend the Structural VAR approach, also based on assumptions of economic theory. Nevertheless, long-run identification schemes transfer to the parameter the uncertainty of the assumptions, and the inference is not reliable. Moreover, empirical evidence suggests that using long-run a priori plausible restrictions generally leads to biased impulse responses (Faust and Leeper, 1997).

In this work, in line with Ferraresi et al. (2015) and Basu and Gautham (2019), we use the economic theory to identify the fundamental shocks through a Cholesky decomposition of residuals for each point in time, assuming that shocks to capacity utilization do not affect the current values of the real exchange rate and the wage share. In sum, seeking to characterize demand regimes in the six high-income countries based on Basu and Gautham (2019), we employ the following order of variables, given by: $\psi_t \rightarrow q_t \rightarrow x_t \rightarrow z_t$.[4] The role of labor productivity growth (x_t) in this framework is crucial to understand the relationship between wage share and capacity utilization because "real wage can change only if there is a change in relatives shares (of wages or profits) or labor productivity" (Blecker, 2011). On the same lines, Basu and Gautham (2019) observe that it is essential to allow for the endogeneity of labor productivity growth when estimating the interaction between wage share and capacity utilization.

Given the causal order of the variables, the first question to be answered is: *what is the effect in high-income countries of an exogenous (unanticipated) shock on the wage share?* Furthermore, given the first answer, we can investigate two complementary questions. *What is the response to "surprising effects" of changes in the real exchange rate on economic activity in developed countries?* For instance, in often recurrent currency crises. Lastly, *what can we expect from an exogenous change in demand conditions (capacity utilization) on the labor income share?*

[3] The difference between the two ways to estimate a VAR is that the error terms are correlated across equations in a reduced form. It requires Cholesky factorization to make the errors orthogonal. In contrast, when estimating the recursive VAR, the error terms are uncorrelated across equations by construction. Given that the same order of variables is used in both cases, they are equivalent for causal interpretations when a researcher uses Cholesky decomposition to identify the source of shocks in the reduced form. See the details in Stock and Watson (2001) and Kilian (2013), and especially Lütkepohl (1991, Chapter 2).

[4] Basu and Gautham (2019) also have used the rate of capital accumulation seeking to characterize the growth regime in the U.S., but our objective is centered only to demand regimes. In addition, they also have used the unemployment rate in the VAR analysis. However, using such a variable may not expand the information set since capacity utilization already conveys unemployment information through Okun law, evidenced by the findings of Basu and Gautham. Moreover, it implies additional parameters to be estimated that may raise the uncertainty of the estimates. See, for instance, Stock and Watson (2001) for applying Okun law in the context of VAR analysis, avoiding a larger number of variables and a larger loss of degrees of freedom.

2.4 Data description

Following the works of Nikiforos and Foley (2012) and Barbosa-Filho and Taylor (2006), we use annual country-level data on the cyclical component of the wage share at factor cost (ψ_t), the cyclical component of the real GDP (z_t), and the cyclical component of the real exchange rate (q_t), and the cyclical component of labor productivity (x_t) given by the ratio of real GDP to average annual hours worked by persons engaged for six advanced countries spanning from 1960 through 2019, a choice primarily based on data availability. We use all variables in the natural logarithm scale. In the Penn World Table dataset, the relative price level, the real exchange rate, is given by the market exchange rate to the purchasing power parity exchange rate (Subramanian, 2010; Feenstra et al., 2015).[5]

We follow Hamilton (2018) in using the cyclical component of the aggregate output as a measure of economic activity. Nikiforos and Foley (2012) also use the cyclical components of wage share and aggregate output to characterize demand regimes. We adopt the same procedure but correct for problems of spurious dynamics by using the Hamilton filter. We follow Stockhammer and Wildauer (2016) in using the wage share at factor cost to measure the functional distribution of income. Most works analyzing demand regimes concentrate only on the US economy.

For example, Barbosa-Filho and Taylor (2006), Nikiforos and Foley (2012), Carvalho and Rezai (2016), and Basu and Gautham (2019) only seek to characterize the demand regimes in the United States. Few works expand the analysis to other countries. In this category, Bowles and Boyer (1995) study demand regimes in five countries (US, UK, France, Germany, and Japan). Stockhammer and Onaran (2004) analyze the US, UK, and France, and Kiefer and Rada (2015) studied seven countries in total (United States, United Kingdom, Sweden, Netherlands, Korea, Japan, and Italy).

Our selected sample is closer to this second category of studies in selecting many countries beyond the US economy seeking to characterize demand regimes. The dataset we have used enjoys the desirable property of generating results comparable across countries and over time. The first criterion has been a high-income country, data availability, and studied before. It allows comparative analyses. Thus, the sample countries are the United States, the United Kingdom, France, Sweden, Austria, and the Netherlands.[6]

The homogeneity of the source and comparability of data across countries and over time are the principal advantages of the Penn World Table dataset. The PWT 10 dataset is freely available at `https://www.rug.nl/ggdc/productivity/pwt/?lang=en`, and it provides data on the real GDP level at constant 2017 national prices (million 2017 USD) and the real exchange rate for our sample countries until 2019. The AMECO database is freely available at `https://ec.europa.eu/`, and it provides the annual data on the wage share for the considered countries, but not for the years before 1960. Except for the wage share at factor cost from AMECO, we extract all other variables from PWT 10.

Tables 1–3 in the Appendix A present the summary statistics of all variables. When comparing the range of variations within variables and countries, the real exchange rate shows the highest volatility, following the pattern documented in other works. We observe positive median changes in the wage share only in the United Kingdom. In all other five countries, the median wage share variation is negative, indicating the general trend of declining labor share in income.[7]

[5] Thus, a rise in this magnitude means a real depreciation and a real competitiveness gain in a given country. We have found a missing value for the average annual hours worked by persons engaged in 1969 for the Netherlands in PWT 10. Thus, we complete that missing value with the average of two neighboring years, 1968 and 1970.

[6] For Japan, no data of wage share at factor cost in AMECO is available before 1980. In the case of Germany, the unification precludes a full homogeneous sample for longer periods.

[7] ILO (2015) and Hutchinson and Persyn (2012) document and discuss the potential causes of the decline of labor share in income in a large number of countries.

France presents the most substantial slowdown in productivity growth, while Sweden and United Kingdom present the highest median growth in labor productivity.

From a data exploratory analysis perspective, Figure 2 presents a rolling window procedure results. We apply the rolling window technique to the equation relating capacity utilization rate explained by the wage share and real exchange rate, as presented by Basu and Gautham (2019, p. 6). This statistical procedure is suitable for verifying whether the conditional mean of capacity utilization can be considered constant over time in our sample of countries (Okimoto and Shimotsu, 2010).

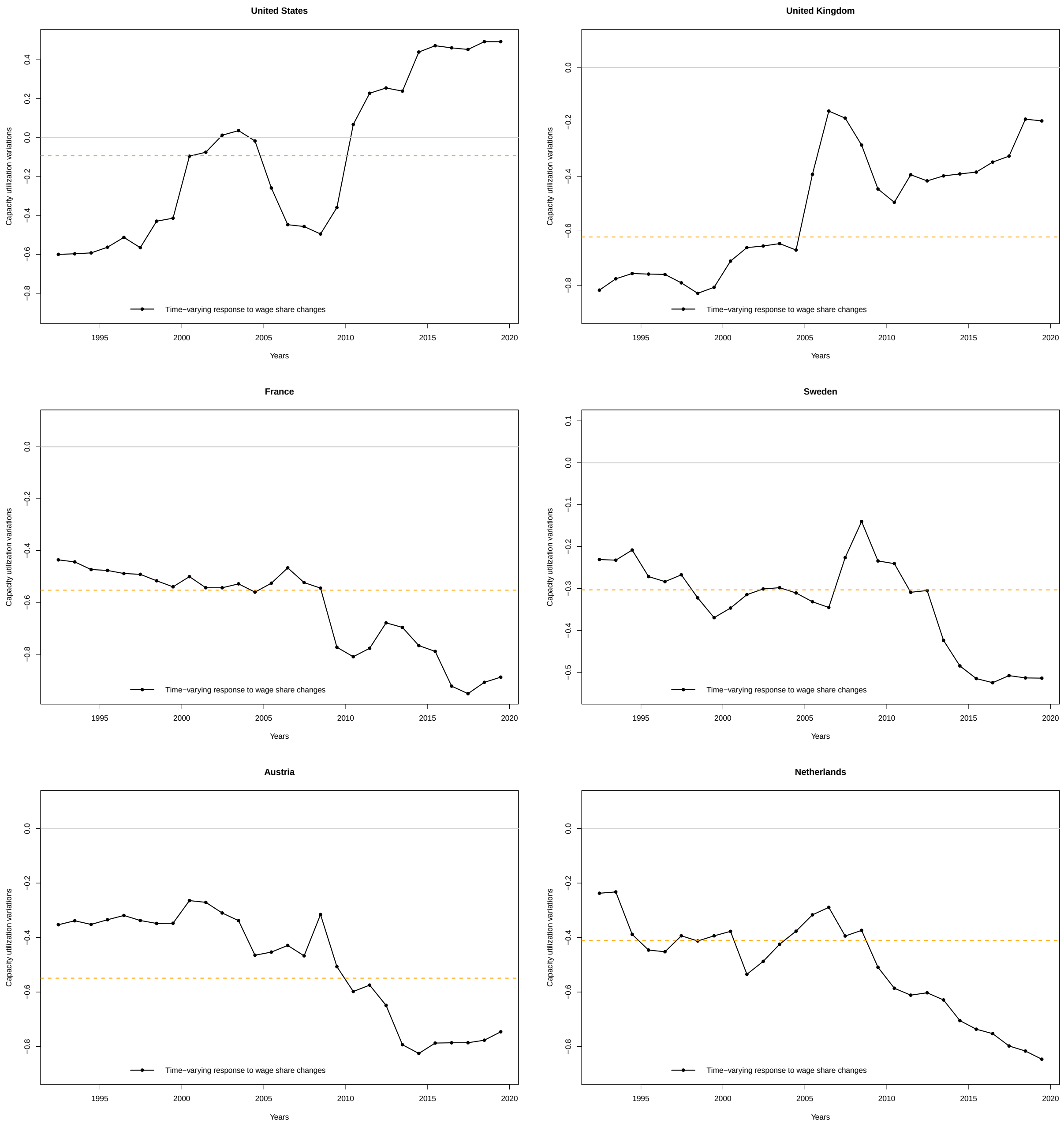

Fig. 2 – Rolling window results. Each black circle in the plot is the response of capacity utilization in a given country to wage share changes ($\hat{\alpha}_{1,t}$) at a given point in time conditional to the real exchange rate changes. We estimate a rolling window of 30 years in the linear regression model given by: $z_t = \alpha_0 + \alpha_1 \psi_t + \alpha_2 q_t + \varepsilon_t$ employing the model of Basu and Gautham (2019, p. 6). We use the cyclical components in the natural logarithm of data from 1963 to 2019; then, we estimate 28 coefficients in each country from 1992 to 2019. The dashed orange line is the OLS estimate based on constant parameter assumption.

In total, we estimate 28 coefficients from 1992 to 2019 using a sample size of $T = 1, \ldots, 30$ for each parameter estimate (black circle) and plot them against years for the six sample countries. We regress capacity utilization against wage share plus real exchange rate to obtain rolling window parameter estimates using Modified Maximum Likelihood estimator for efficiency gains and control for outliers (Venables and Ripley, 2002). Figure 2 shows an unstable relationship between the wage share and capacity utilization that change in sign and/or magnitude over the years in all sample countries.

The response of capacity utilization to wage share changes in the US economy and UK is consistent with the view that these countries pass through great structural changes in their macro relationships. We observe an upward trend in the relationship between capacity utilization and income distribution in the UK and the US. In contrast, in all other four countries of the sample, the response of capacity utilization to labor income share presents a robust declining trend over time, conditional on the international competitiveness evolution. These findings suggest that a model with a constant conditional mean assumption is hard to reconcile with data.

The limitation of this exploratory analysis for formal inference is that it does not account for the full simultaneity determination of the variables. The Primiceri (2005) VAR model can simultaneously account for these endogenous variables' mean and volatility changes. As a system of endogenous variables, capacity utilization's mean response to exogenous changes in wage share, labor productivity growth, and real exchange rate can freely vary over time.

3 Results and discussion

The impulse response shows the response of current and future values of each of the variables to a one standard deviation shock to one selected variable of one of the VAR errors, assuming that all other errors are zero. Figures from 3 to 11 in Appendix B display the impulse response functions for the Bayesian VAR with time-varying coefficients and stochastic volatility applied to the sample of countries.

We conduct the experiment using a 95% credible interval of simulated impulse responses. The impulse response can inform about the sign, magnitude, significance, and how persistent the shock is over time. For the United States (Figure 3 – Panel A – left), we observe a negative and significant result for the response of capacity utilization after one standard deviation shock to wage share. The sign and significance of this shock in the U.S. economy are consistent with the finding presented by Basu and Gautham (2019) using quarterly data. Although they have found five quarters in duration, our results indicate that negative response of economic activity fades away at most in two years.

Analyzing the response of capacity utilization in all other five countries of the sample (Figures 3, 4, and 5) to 1-standard deviation shock to the wage share, we have found similar results as the U.S. economy: the sign is negative and significant; after a 1-standard deviation shock to wage share, we observe a significant decline in capacity utilization in UK, France, Sweden, Austria, and the Netherlands. The average duration of this effect ranges from 1 to 2 years to fades away, varying according to the specific country.

Thus, the principal conclusion of the paper is that, in all six countries of our sample, demand can be characterized as profit-led, even when our methods consider time-varying conditional means and stochastic volatilities in a VAR, using an identification strategy based on sound theoretical grounds.

The other two complementary questions of the paper are essential to provide qualifications to our first conclusion. Sasaki et al. (2013) discuss the conditions under which governments devaluate their home currencies that could effectively raise output (capacity utilization), improving their trade balance when the economy is profit-led. However, even when the trade balance is improved, the capacity utilization rate does not necessarily rise. Specifically, to succeed in depreciation policy in a domestic profit-led regime, firms must bear the burden originating from international price competition (Sasaki et al., 2013).

In this regard, our findings (Figures 6, 7, and 8) indicate that only in the U.S. and Sweden, the response of capacity utilization to 1-standard deviation shock to the real exchange rate is significant and positive, being more persistent in the latter. On the other hand, for the other four countries of the sample, the "surprise effects" of real exchange rate changes do not influence output (capacity utilization). Although all six countries have been operating under a profit-led regime, that condition is necessary but not sufficient to generate a significant, positive response of capacity utilization to an exogenous change in the real exchange rate, as put forward by the theoretical model of Sasaki et al. (2013).

Lastly, knowing that our sample countries operate predominantly in a profit-led regime, we also notice that the response of labor income share to 1-standard deviation shock to the capacity utilization is positive and significant only in the U.K., Sweden, and Austria. The effect is positive and persistent, and it tends to disappear in 3 to 4 years. Nonetheless, in the U.S. economy, France, and the Netherlands, we have found no evidence of the labor share responding to unanticipated changes in capacity utilization.

We must realize that all these analyses account for endogenous labor productivity growth, indicating that these findings are invariant to differences across countries in this variable, at least in the short and medium run.

4 Conclusions

This paper applies the Bayesian VAR model with time-varying coefficients and stochastic volatility for characterizing demand regimes in six high-income open economies. We employ the PWT 10 annual dataset from 1960 to 2019 designed for international comparison across countries and over time.

A rolling window regression shows that the conditional mean of capacity utilization to wage share and the real exchange rate changes is unstable over the years. The analysis of the impulse response functions leads to three main conclusions. First, in all six countries of our sample, demand can be characterized as profit-led, even when employed methods consider time-varying conditional means and stochastic volatilities in a VAR, using an identification strategy based on sound theoretical grounds.

Second, although all six countries have been operating under a profit-led regime, that condition is necessary but insufficient to generate a significant, positive response of capacity utilization to an exogenous change in the real exchange rate. In particular, firms must bear the burden originating from international price competition. Only in the U.S. and Sweden, the response of capacity utilization to 1-standard deviation shock to the real exchange rate is significant and positive. On the other hand, the "surprise effects" or devaluation policy of real exchange rates do not influence capacity utilization for the other four countries of the sample.

Lastly, the response of labor income share to 1-standard deviation shock to the capacity utilization is positive and significant only in the U.K., Sweden, and Austria. In sharp contrast, in the U.S. economy, France, and the Netherlands, we have found no evidence of the labor share responding to unanticipated changes in capacity utilization.

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Appendix A: Summary statistics of data

Table 1 – Descriptive statistics

	United States				*United Kingdom*			
	ψ_t	q_t	x_t	z_t	ψ_t	q_t	x_t	z_t
Median	-0.0015	0.0036	0.0022	0.0068	0.0039	0.0056	0.0052	0.0080
SD	0.0143	0.0213	0.0205	0.0292	0.0274	0.1450	0.0258	0.0321
Maximum	0.0350	0.0524	0.0385	0.0532	0.1072	0.2417	0.0446	0.0597
Minimum	-0.0343	-0.0681	-0.0553	-0.0821	-0.0671	-0.3324	-0.0843	-0.0956

Table 2 – Descriptive statistics

	France				*Sweden*			
	ψ_t	q_t	x_t	z_t	ψ_t	q_t	x_t	z_t
Median	-0.0038	0.0063	-0.0024	0.0012	-0.0015	-0.0043	0.0062	0.0048
SD	0.0185	0.1431	0.0250	0.0212	0.0318	0.1478	0.0339	0.0319
Maximum	0.0626	0.2469	0.0589	0.0365	0.0890	0.3231	0.0639	0.0604
Minimum	-0.0365	-0.3689	-0.0585	-0.0507	-0.0592	-0.3193	-0.1007	-0.0867

Table 3 – Descriptive statistics

	Austria				*Netherlands*			
	ψ_t	q_t	x_t	z_t	ψ_t	q_t	x_t	z_t
Median	-0.0031	0.0051	0.0005	0.0022	-0.0003	-0.0089	0.0018	0.0020
SD	0.0200	0.1482	0.0234	0.0239	0.0247	0.1433	0.0278	0.0288
Maximum	0.0519	0.2532	0.0755	0.0480	0.0439	0.2574	0.0575	0.0474
Minimum	-0.0520	-0.4349	-0.0459	-0.0529	-0.0588	-0.4176	-0.0832	-0.0844

Appendix B: Time-varying IRFs with 95% credible interval

United States and United Kingdom

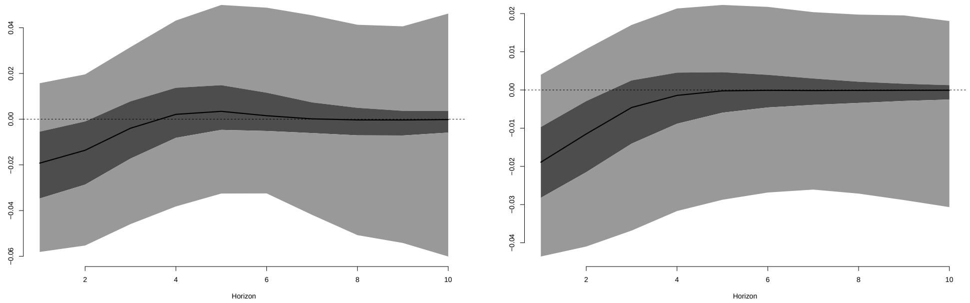

Fig. 3 – **Panel A. United States (left) and United Kingdom (right). Impact of 1-standard deviation *shock to the wage share* and impulse response for *capacity utilization* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**

France and Sweden

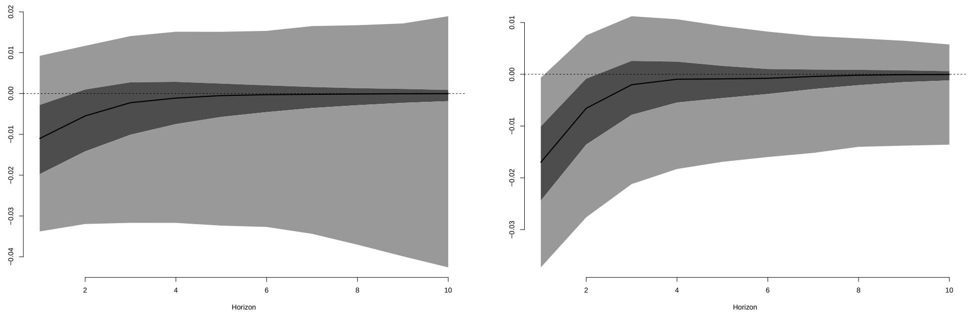

Fig. 4 – **Panel B. France (left) and Sweden (right). Impact of 1-standard deviation *shock to the wage share* and impulse response for *capacity utilization* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**

Austria and the Netherlands

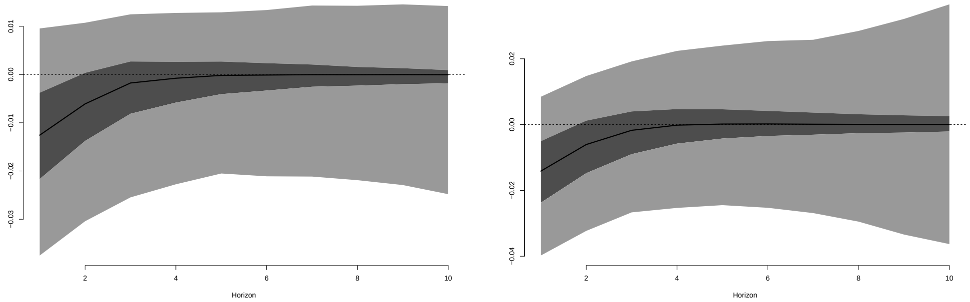

Fig. 5 – **Panel C. Austria (left) and the Netherlands (right). Impact of 1-standard deviation *shock to the wage share* and impulse response for *capacity utilization* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**

United States and United Kingdom

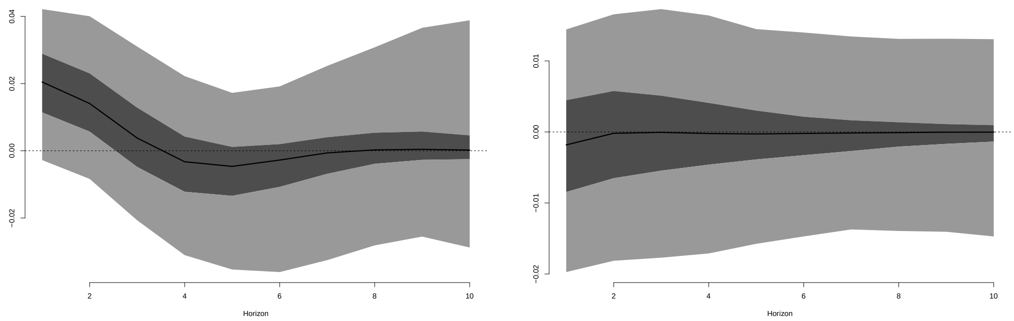

Fig. 6 – **Panel A. <u>United States (left) and United Kingdom (right)</u>. Impact of 1-standard deviation *shock to the real exchange rate* and impulse response for *capacity utilization* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**

France and Sweden

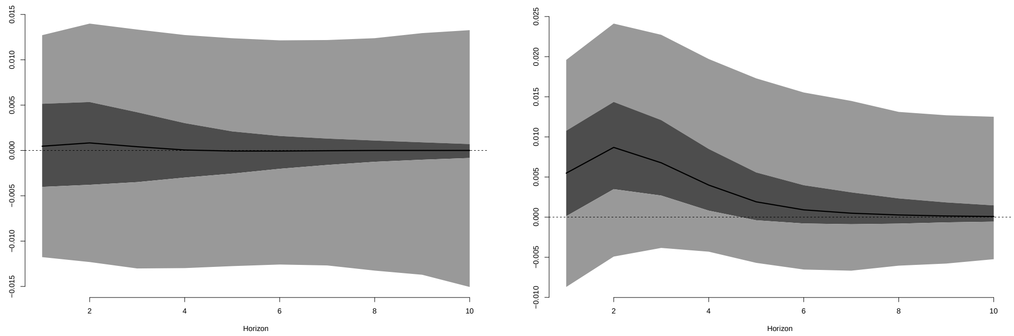

Fig. 7 – **Panel B. <u>France (left) and Sweden (right)</u>. Impact of 1-standard deviation *shock to the real exchange rate* and impulse response for *capacity utilization* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**

Austria and the Netherlands

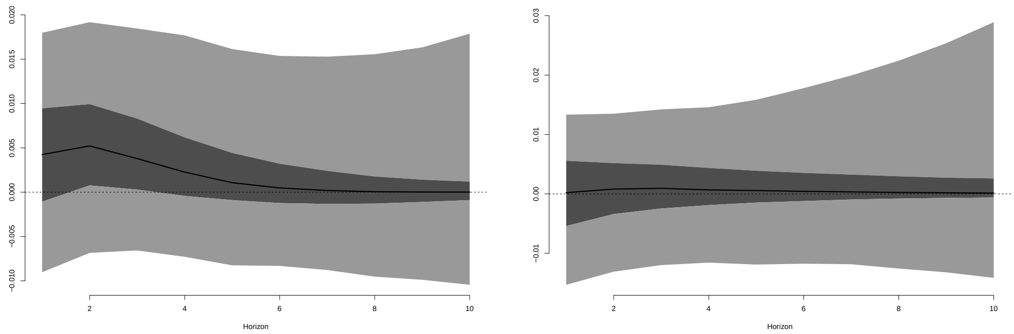

Fig. 8 – **Panel C. <u>Austria (left) and the Netherlands (right)</u>. Impact of 1-standard deviation *shock to the real exchange rate* and impulse response for *capacity utilization* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**

United States and United Kingdom

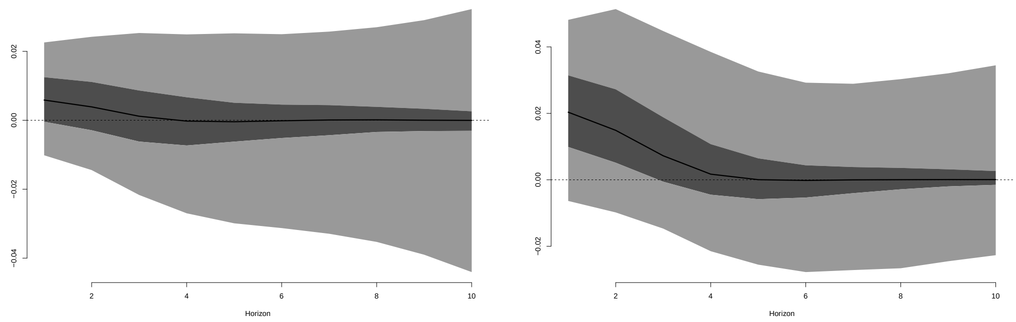

Fig. 9 – **Panel A. United States (left) and United Kingdom (right). Impact of 1-standard deviation *shock to the capacity utilization* and impulse response for *wage share* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**

France and Sweden

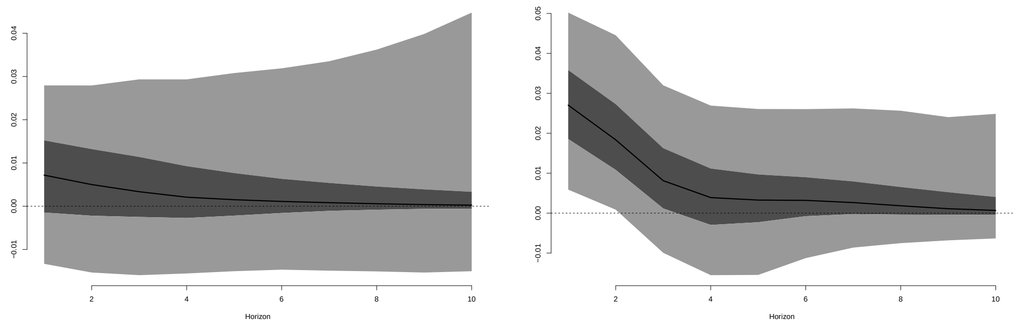

Fig. 10 – **Panel B. France (left) and Sweden (right). Impact of 1-standard deviation *shock to the capacity utilization* and impulse response for *wage share* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**

Austria and the Netherlands

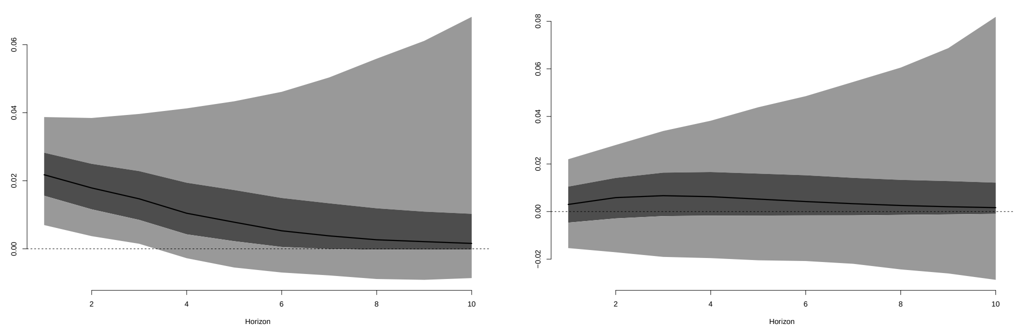

Fig. 11 – **Panel C. Austria (left) and the Netherlands (right). Impact of 1-standard deviation *shock to the capacity utilization* and impulse response for *wage share* based on causal ordering $\psi_t \to q_t \to x_t \to z_t$.**