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How to cite

CARRILLO-MALDONADO, Paul, NIKIFOROS, Michalis. Estimating a Time-Varying Distribution-Led Regime. In: Structural change and economic dynamics, 2024, vol. 68, p. 163–176. doi: 10.1016/j.strueco.2023.10.013

This publication URL: https://archive-ouverte.unige.ch/unige:175672
Publication DOI: 10.1016/j.strueco.2023.10.013

Structural Change and Economic Dynamics 68 (2024) 163–176

Contents lists available at ScienceDirect

Structural Change and Economic Dynamics

journal homepage: www.elsevier.com/locate/strueco

Estimating a Time-Varying Distribution-Led Regime

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ARTICLE INFO

JEL Classifications:
E11
E12
C11
C3

Keywords:
Wage-led
Profit-led
Distribution
Growth
Time-Varying Parameters (VAR)

ABSTRACT

This paper estimates the distribution-led regime of the US economy for the period 1947–2019. We use a time varying parameter model, which allows for continuous changes in the regime over time. To the best of our knowledge this is the first paper that has attempted to do this. This innovation is important, because there is no reason to expect that the regime of the US economy (or any economy for that matter) will remain constant over time. On the contrary, there are significant reasons that point to changes in the regime. We find that the US economy became more profit-led in the first postwar decades until the 1970s and has become less profit-led since. In the last fifteen years of our sample the effect of changes in distribution on economic activity is statistically insignificant.

1. Introduction

The introduction of the concept of wage- and profit-led growth by Bhaduri and Marglin (1990) has led to an extensive theoretical literature that extends the basic model as well as a large empirical literature that aims to estimate the regime of various countries. The underlying assumption of many of these—especially empirical—contributions is that the regime of an economy is constant. An economy is assumed to be *either* wage-led *or* profit-led. For example, the usual practice in the empirical literature is to obtain the data for distribution and utilization or the growth rate for an economy, run a regression for the time-period the data are available, and, based on the regression's results, conclude if the economy under examination is wage- or profit-led over this period of time. In the case of the US economy, which is the object of a large portion of these studies, quarterly data are available beginning in 1947. Thus, the implicit assumption in the related regressions is that the regime of the US economy has been constant in the period starting in 1947 and ending in the 1990s, 2000s, or 2010s when the study was conducted.

Some empirical studies have attempted to allow for time-variation of the regime by estimating the model for different sub-periods in addition to the whole available sample. The usual cutoff point is a period around year 1980. This is a step in the right direction, but it still makes the implicit assumption that the regime has been constant over each sub-period.

However, as some theoretical contributions have argued it is unlikely that the demand-led regime remains constant over time, as the structure of the economy and income distribution changes. There are important logical, theoretical, and empirical reasons that justify the change of the regime over time. In the aforementioned example, it is unlikely that the reaction of macroeconomic activity to changes in distribution in the United States was the same in the 1950s, the 1970s, the 1980s, the 2000s, and the 2010s–or even in just the 1980s and the 2010s.

Moreover, as is explained in Nikiforos (2016b, 2022), it is likely that the regime of the economy changes endogenously. In particular, Nikiforos puts forward three hypotheses. First, that an economy should become less profit-led (or more wage-led) as the profit share increases—a possibility already suggested by Taylor (1990) and Palley (2014). Second, the more powerful a class becomes, the more it is able to push distribution in its favor—thus distribution is unstable. Third, the change in distribution also depends on the regime itself: the more profit-led the economy is, the more likely it is that the profit share will increase and vice versa. The result of these three hypotheses is cyclical fluctuations in growth and distribution. As the profit (wage) share increases, the economy becomes more (wage-) profit-led and thus eventually a crisis ensues. The crisis becomes the catalyst for a reversal in the

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https://doi.org/10.1016/j.strueco.2023.10.013
Received 9 February 2023; Received in revised form 25 October 2023; Accepted 29 October 2023
Available online 31 October 2023

direction of the change in income distribution.

In the context of the US economy these hypotheses imply that: (i) the large increase in income inequality and the profit share over the last forty years should have made the US economy less profit-led; and (ii) the profit-ledness of the US economy should have increased in the early postwar decades, a development that contributed to the (profit-squeeze) crisis of the 1970s.

The present paper is, to the best of our knowledge, the first attempt to estimate the regime of an economy while allowing for *continuous* changes in the regime itself over time. Toward that purpose we employ a time varying parameters (TVP) model and apply it to US data for the period 1947–2019. We employ different specifications. Our estimates confirm that the US economy became more profit-led in the first postwar decades until the 1970s and has become less profit-led over the last four decades, converging to a neutral—neither wage-led nor profit-led—regime after the early 2000s. These results are robust to different specifications.

Besides the interest these results have in their own right, our paper and its novel methodological approach aims to point toward a new direction for thinking and estimating distribution-led regimes that considers potential changes in the regimes over time. These changes are very important for the political economy of the countries under consideration. For example, in the case of the United States, the climax of profit-ledness in the 1970s is crucial for understanding the crisis of the time and the political economy of the period. The same is true for non-profit-ledness of the last two decades.

The rest of the paper proceeds as follows. Section 2 summarizes the theoretical arguments about why the distribution-led regime might change over time. Section 3 provides an overview of the empirical literature. Section 4 presents our methodological approach, the time varying parameter model. In section 5 we discuss our results. Section 6 concludes.

2. Wage- and profit-led growth

The closure of the Kaleckian/Structuralist model of growth and distribution (Rowthorn 1981; Taylor 1983; Dutt 1984; Blecker 1989; Kurz 1990; Bhaduri and Marglin 1990) combines the Keynesian/Kaleckian emphasis on the autonomous role of aggregate demand and the classical emphasis on institutions and social norms as the main determinants of the distribution of income between workers and capitalists. A change in the distribution of income does not have a certain a priori effect on the level of macroeconomic activity because profitability has differential effects on the various components of aggregated demand. An increase in the profit share: i) has a negative effect on consumption, because workers have a higher propensity to consume; ii) has a positive effect on investment, because profitability is one of the main determinants of investment; and iii) has an uncertain effect on net exports depending how the change in the profit share comes about. Thus, the overall effect will depend on the relative magnitude of these partial effects. An economy is profit-led if the positive effect of an increase in the profit share on investment and exports is stronger than the negative effect on consumption. It is wage-led in the opposite case.

Obviously, since even in the baseline model the demand regime depends on the propensities of consumption, investment and net exports with respect to distribution, and these propensities may change, the regime should not be fixed. Nevertheless, a big part of the literature that has followed the aforementioned early contributions has assumed that the regime of each economy is constant over time.

There are some important exceptions to this rule, which can be broadly classified in two categories: i) non-linearities of demand and/or distribution and ii) other structural factors that affect the regime of an economy. In the latter case, one could argue that since these factors change over time so does the regime itself. However, even in many of these cases the change of the regime over time is an afterthought. For example, the non-linearities are simply mentioned as a possibility; or when it comes to the structural factors, they are discussed more in a cross-sectional rather than a time-varying context (i.e., they aim to explain why the regime in some countries is different than some other countries).

2.1. Non-linearities

The possibility of non-linearity of demand is already discussed by Marglin and Bhaduri (1990, 169-171) who suggest that demand might be non-linear in distribution (wage[profit]-led for low [high] levels of the of the profit share) or utilization (wage[profit]-led for low [high] levels of the of utilization). Although, these non-linearities are not discussed much, Marglin and Bhaduri provide an interpretation of the demise of the "golden age of capitalism" based on a change of the regime of the economy (together with other changes and shocks to demand, prices and institutions).

Taylor (1990) suggests another possibility that an economy can be wage-led at low level of wages but profit-led at high levels, because investment becomes more sensitive to the real wage as the latter rises. Palley (2014) makes a similar point with respect though to the wage share. For Palley, as the wage share decreases the propensity to invest out of profits decreases due to higher adjustment costs, while at the same time the propensity to save out of profits increases.

Nikiforos and Foley (2012) suggest that the distributive schedule is nonlinear: the wage share is decreasing for low levels of utilization and increasing for high levels. Coupled with a monotonic demand schedule, there is the possibility of two equilibria. In this case, even if demand is profit-led, an increase in the profit share is contractionary for the low-utilization equilibrium.

Assous and Dutt (2013) propose that the markup and profit rate aren't constant over time because the market structure, workers' power, and firms' concentration change. They thus suggest that distribution has a downward-facing S-shape in the <profit share, growth rate> space. This creates the possibility of three equilibria. As a result, they conclude that it is necessary to understand that there are small and large changes. Small changes do not move the system to a different equilibrium, but large shocks can do that. Therefore, even if demand is profit-led, a large increase in the relative power of firms might lead to a shift to a low-growth equilibrium (accompanied by a higher profit share). Tavani et al. (2011) use nonparametric methods to determine the distributive schedule and reach similar conclusions.

More recently, Marglin (2017) revisits the possibility mentioned in Marglin and Bhaduri (1990) that over the course of the business cycle, investment's reaction to *current* profitability varies. During a crisis—at low levels of utilization—entrepreneurs are less sensitive to distribution and are more interested in the economy's performance. Profitability plays a more important role at high levels of utilization. Therefore, Marglin concludes, the regime of the economy is different at different phases of the cycle: an economy tends to be wage-led during a crisis and profit-led at high levels of utilization.

Finally, Nikiforos (2016b, 2022) examines the evolution of the distribution-led regimes in the long run. He suggests that an economy tends to become less profit-led (or more wage-led) as the profit share is increasing. As was mentioned above this possibility was earlier proposed by Taylor (1990) and Palley (2014). Since we will use these arguments in the following sections, it is worth going over them quickly. There are at least four set of reasons why the distribution-led regime of an economy cannot be a permanent feature of that economy, irrespective of income distribution and other structural characteristics, including:

i) *Logical reasons*. If an economy is either wage- or profit-led and income distribution did not matter in the determination of the regime, it would follow that the optimal macroeconomic performance would be achieved when the profit or wage share, respectively, is equal to zero. This is clearly absurd.

ii) *Theoretical reasons*. There are several theoretical reasons why the propensity of investment and consumption with respect to the profit share might decrease as the profit share increases.[1] More fundamentally, the very basis for the distinction between wage- and profit-led growth is the dual nature of wages. Wages are at the same time a cost of production, whose increase tends to reduce profitability and thus investment, and the income of the major part of the population (with high propensity to consume) whose increase tends to increase consumption. The argument that an economy is either wage- or profit-led implies that one of these two "natures" of wages is always dominant. However, this contradicts the spirit of the Kaleckian/Structuralist model and the very concept of distribution-led growth.

iii) *Empirical reasons*. There is empirical evidence from other bodies of literature that the propensities of the components of aggregate demand with respect to profitability have changed over time. For example, the financialization literature has shown that over the last four decades there has been a decoupling of profit flows and investment. This piece of evidence is inconsistent with a constant distribution-led regime over that period.

iv) *History-of-thought reasons*. The distinction between wage- and profit-led growth emerged from a research project emphasizing that the regime changes over time (Marglin 1988; Marglin and Schor 1990). Marglin and Bhaduri (1990) discuss the changes in the distribution-led regime of the US economy as a factor that contributed to the demise of "The Golden Age of Capitalism."

For all these reasons the hypothesis that an economy becomes more wage led as the profit share increases and vice versa seems convincing. Given the significant increase in the profit share over the last decades we would expect that economies like the one of the United States have become less profit led.

Finally, regarding the behavior of distribution, Nikiforos (2016b, 2022) assumes that: (i) distribution is unstable—meaning that each class becomes more able to tilt distribution in its favor as its share of income is increasing, and (ii) that the change in distribution is also affected by the distribution-led regime (in a wage-led economy the profit share would tend to decrease, all other things equal, and vice versa). This endogenous change in distribution and the distribution-ledness of the economy are likely to lead to endogenous long-run cycles, with the economy moving endogenously between periods of wage- and profit-led growth.

In the case of the United States this explanation suggests that in the early postwar period the US economy became more profit led as distribution of income became more egalitarian. This led to the crisis of the 1970s, which was a profitability crisis. It was this crisis that catalyzed the change in the trajectory of income distribution and the increase in income inequality that ensued. At the same time, this increase in inequality and the profit share made the US economy less profit-led and led to the crisis of 2007–9.

2.2. Structural factors

In addition to non-linearities of demand and/or distribution, some contributions have also demonstrated that the regime of an economy might depend on a series of structural factors. It follows that as these factors might change over time, so does the regime of the economy itself.

A first set of these factors is related to the foreign sector of the economy. As it was first suggested by Krugman and Taylor (1978), while discussing the potentially contractionary effects of devaluation, and then more systematically by Blecker (1989) the macroeconomic effect of a redistribution of income towards wages depends on how this redistribution comes about (an increase in unit-labor cost or a decrease in the markup) as well as factors such as the trade balance, the openness of the economy as well as how elastic are exports and imports to prices and the level of income.

Another factor that might affect how an economy will react to a change in functional distribution is the size distribution of income. Carvalho and Rezai (2016) and Palley (2017) have shown that if the saving propensity is positively related to the level of income, then the more unequally distributed wages are, the more profit-led the economy will tend to be.

Related to that Tavani and Vasudevan (2014) build a three class model (workers, managers and capitalists) and show that the effect of redistribution towards wages depends on the responsiveness of investment to profitability, the level of income inequality, as well as the saving propensity of the managerial class. Finally, Vasudevan (2017), in the context of a financialized economy, shows that shareholder primacy class and credit-driven demand tend to make an economy more wage-led.

3. Empirical literature

The introduction of the distinction between wage- and profit-led growth has led to a very extensive empirical literature that aims to estimate the regime of various economies around the world. A comprehensive review of this literature is provided by Blecker (2016). In his terminology, there are two main approaches for the estimation of the regime: the "structural" and "aggregative" approaches. The structural approach decomposes demand into its various components (consumption, investment, and net exports) and estimates the effects of changes in distribution on each of these components individually. The overall regime is then calculated as the sum of these individual effects. On the other hand, the aggregative approach estimates the effect of changes in distribution on the growth rate of total output, or the rate of capacity utilization.

The obvious benefit of the structural approach is that one can distinguish between the effects of redistribution on the different parts of economic activity, and therefore the process that produces these results is transparent. On the other hand, these contributions suffer from serious endogeneity problems. Since causality between distribution and growth runs both ways, the simple ordinary least square (OLS) regressions that are commonly used capture the correlation between the variables under investigation rather than the causal effect of (changes in) distribution on growth. Moreover, the estimation of separate equations for the various components of demand cannot capture potentially important dynamic interactions among the variables under examination (Basu and Gautham 2020, Blecker et al. 2022). Finally, another weak point of this approach is that the investment function is famously difficult to estimate. The strategy that is usually employed is that if the coefficient of the regression of investment on distribution is statistically insignificant, it is treated as zero. This can explain why this approach tends to show that economies are wage-led. On the other hand, the aggregative approach has the advantage of dealing with the endogeneity problem, as related contributions usually employ vector autoregressive models (VARs) or use instrumental variables and do not have to specify an investment function—at the cost of not being able to distinguish between the different components of aggregate demand.

The discussion in the previous section reveals another problem in this literature, namely that the regime of the economy is taken to be fixed over the whole period of estimation. The usual strategy is to use data for a country, run a regression, and conclude if the economy is wage- or profit-led. For example, in the case of the United States, data are available in quarterly frequency since 1947. The implicit assumption of most studies is that the distribution-led regime of the economy was the same for the period beginning in 1947 until the last year of the sample (in the 1990s or the 2000s). For the reasons explained in the previous section this is problematic.

More precisely, out of the roughly thirty five different studies that have published estimates on distribution-led regimes, very few engage

[1] A detailed discussion is provided in Nikiforos (2016b: sec. 3.2; 2022: sec. 6)

with the possibility of time variation of the regimes. Barbosa-Filho and Taylor (2006) estimate their model for the postwar period until 2002. They find that demand was less profit-led in the period before 1970. In a similar fashion, Nikiforos and Foley (2012) estimate the regime for the period 1948–2009 and the subperiods before 1960, before 1970, and after 1970, and find that the coefficients for the first two subperiods are not statistically significant while they are (indicating a profit-led economy) for the period after 1970.

Carvalho and Rezai (2016) apply a threshold VAR model to data for the period 1967–2010. Using the Gini coefficient as the threshold variable they identify 1981 as the threshold year; they then find that the US economy was more profit-led in the years after 1981. Alternatively, Barrales and von Arnim (2017) use data for the period 1949–2011. They show that over the whole period of their sample and the period before 1980 an increase in the wage share has a negative effect on macroeconomic activity; this is not the case in the post-1980 period, when an increase in the wage share tends to have a positive effect in the medium run. Mendieta-Muñoz et al. (2022) find that wage bargaining power had a significant negative effect on output in the immediate postwar period (1948-1984) but no effect in the period that followed (1985-2018 in their sample). They also find that the positive effect of productivity on output was weaker during the second period. Overall, these results imply a weaker reaction of output to changes in the wage share in the second period.

In another recent paper, Blecker et al. (2022) estimate the effect of redistribution on demand for the US economy for the period 1963-2016, and for the sub-periods until and after 1981. The interesting innovation of their approach is that they distinguish between two different types of shocks that can change the profit share: the monopoly power of the firms and the unit labor cost (ULC). As explained in the previous section, and along the lines of Blecker (1989), the effect of a change in distribution on demand depends on how this change comes about. Indeed Blecker et al. find that a decrease in the profit share as a result of a fall in monopoly power has in general more positive effects on demand, compared to a decrease that is the result of an increase in the ULC. Moreover, they find that a rise in the ULC had generally a negative effect on demand during the period 1963-1981, but a positive effect in the period 1982-2016.

In addition to these studies that have focused on the US economy, Stockhammer et al. (2011) estimate the regime of the German economy over the period 1970-2005, and the sub periods before and after 1987. They find that the German economy was less wage led in the second period, which they attribute to globalization and the increase in the openness of the economy. Jetin and Kurt (2016) estimate the regime of the Thai economy for the period 1970–2011. They find that the economy was profit-led over the whole period of their sample; they also estimate their model for the period after 1980 and find a lower degree of profit-ledness.

Finally, Stockhammer, Onaran, and Ederer (2009) and Stockhammer and Stehrer (2011) investigate potential structural breaks in the data with the use of related tests, but they do not find any.[2] Cauvel (2022) also mentions that his results for the entire sample (1947-2016) do not change when he runs his model for three sub-periods, 1947-1970, 1970-1993 and 1993-2016.

The summary provided in the previous paragraphs reveals three points. First, the theoretical insights (discussed before) and their intuition has led to some empirical studies that have tried to examine changes in the regime over time. Second, this type of studies remains the minority in the empirical literature. Third, even the empirical studies that have engaged with potential changes of regime over time assume that the regime is fixed over long subperiods (e.g., pre/post-1970, pre/post-1980).[3] For the reasons discussed in the previous sections these periods are themselves subject to significant change. This is one of the major advantages of the empirical strategy we follow, as it allows for *continuous* changes in the regime itself over time.

4. Empirical Strategy

The goal of our paper is to estimate the effect of changes in income distribution on macroeconomic activity. As it is common in the related empirical literature, we used the wage share as a measure of income distribution. In our baseline model we used the growth rate of real gross domestic product (GDP) to measure macroeconomic activity.

The empirical strategy we chose was dictated by two concerns. First is the potential endogeneity of income distribution to macroeconomic activity. For that reason, a simple OLS regression of growth on distribution gives inconsistent estimators, which capture the correlation between the two variables rather than the causal effect of changes in distribution on growth. Second, for the reasons explained in section 2, this effect might vary over time. This also raises issues for the consistency of the estimators that do not take these changes into account.

With these concerns in mind, we chose to use a time-varying parameter structural vector autoregressive (TVP-SVAR) model (Primiceri 2005; Nakajima 2011; Koop and Korobilis 2010); a brief overview of the method is provided in the appendix. In a nutshell, the main difference between the TVP-SVAR and a conventional SVAR is that the structural parameters of the model are allowed to vary over time and are thus able to capture time variation in the contemporaneous relationship and lag structure of the model. It is then up to the data to determine whether the variation of this structure comes from changes in the size of shocks or the propagation mechanism (Kim and Nelson 1999).

For the estimation of the model, we used the relatively standard methods employing the Kalman filter, Bayesian inference, and a Markov chain Monte Carlo (MCMC) algorithm. We ran 12,000 draws to estimate the conditional posterior distribution of the parameters. To mitigate the initial values, we discarded the first 2,000 draws ("burn-in" simulations). We also experimented with a higher number of draws—up to 100,000—but our results do not change in any meaningful way.

We used quarterly series up to the last quarter of 2019. On the other hand, we went as far back in time as possible. The time range of each of our models was determined by data availability. Finally, we chose the number of lags with the usual Schwartz and Hannan-Quin information criteria in a traditional-invariant structural VAR and solved the model in Matlab.[4]

4.1. Variable Ordering

For the identification of the model, we followed the usual Cholesky decomposition, where we assumed that the wage share is exogenous to GDP in the contemporaneous relationship ($t = 0$). As is common in these types of econometric exercises, our results are sensitive to this ordering

[2] In personal discussions, Englebert Stockhammer mentioned that in many of the various related papers he has coauthored, they estimated the model for different subperiods, but the results were not reported, as they did not find significant changes.

[3] This is due to the methods that they are being used, although the intuition of those who conduct these studies might be different. A conventional VAR model run over whatever period of time assumes that the relationship that is being estimated is constant over this period.

[4] For our simulations we benefited from the Matlab code provided by Koop and Korobilis (2010).

assumption (Basu and Gautham 2020, Cauvel 2022). [5] We are comfortable with this assumption, as it is consistent with the classical theory of distribution, which is also adopted in the Kaleckian/Structuralist model and posits that income distribution is primarily determined by institutions and social norms. In fact, as it is explained in Basu and Gautham (2020), Barrales-Luiz et al (2021) and Cauvel (2022), a reverse ordering where distribution adjusts faster than economic activity, would not be in line with the theoretical framework of the Kaleckian model.

A question here is what one means by distribution (is it the wage share or the wage rate?) and what is the role of productivity within it? This is important because as Cauvel (2022) shows that the results of an SVAR regression are sensitive not only to the ordering between the wage share and the measure of economic activity (Cauvel uses the rate of capacity utilization) but also to the ordering of the components of the wage share (real wage and productivity) if one opts to use them in a regression. In other words, the results of the orderings < wage →productivity→utilization> and <productivity→wage → utilization>, both of which are consistent with wage share coming before utilization, are different.

Going back to the classical theory, distribution being *primarily* determined by institutions and social norms means that distribution is *primarily* determined outside of the market sphere (as opposed for example to the neoclassical theory, where distribution is purely determined within the markets of the various factors of production based on the laws of demand and supply). It is for that reason that this theory suggests an ordering where the wage share comes first and economic activity—*or for that matter any economic variable*—comes after. Following this logic, and for the same reasons, if we want to move to a lower level of abstraction and decompose the wage share, real wage has to come first; an ordering with productivity coming before the real wage is not consistent with the classical theory of distribution. Therefore, even if one wants to examine the role of changes in productivity on the relation between distribution and growth, the distributional variable still needs to come first.

Two final points are in order here. First, the fact that distribution is primarily determined outside the economy by institutions and social norms does not mean that economic forces do not play a role. The relevant literature has identified several economic variables that could affect distribution. For example, the utilization rate or the employment rate may affect the wage share: an increase in utilization/employment may increase the bargaining power of workers and lead to an increase in the wage share; or, due to the existence of overhead labor, it may lead to labor productivity gains which in turn lead to a decrease in the wage share.[6] In fact, as it was stressed at the beginning of this section one of the motivations for choosing the TVP-SVAR approach was to explicitly account for the endogeneity of distribution which leads to biased estimators when a simple OLS regression is applied.

Second, the SVAR approach has well-known advantages for the identification of the model under consideration, but the ordering of the variables imposes certain restrictions which can be debatable. Consider, for example, the simple <wage share, utilization> model with the ordering going from the former to the latter (meaning that utilization is not allowed to have a contemporaneous effect on the wage share). The wage share is by definition the wage bill over output, and therefore a change in output/utilization has by definition an effect on the wage share. This contemporaneous effect is suppressed with the ordering of the variables. The same is true for any model where the wage share is ordered before productivity (the wage share is by definition wage rate over productivity) or where productivity is ordered before output (productivity is also by definition output over employment).[7] This caveat should be borne in mind when interpreting our results (or, for that matter, the results of any VAR model with variable ordering).

4.2. Model Variations

In addition to the baseline model, we estimated—using the same strategy—a series of other models with additional or different variables. These variations can serve as robustness checks and provide some evidence on the sensitivity of the results on the particular specification. They fall into four broad categories.

4.2.1. Including the Debt-to-Disposable-Income Ratio of Households as an Endogenous Variable

Changes in indebtedness can play an important role in the relationship between distribution and growth, as they can mitigate or exacerbate whatever effect changes in income distribution has on growth. It is likely, for example, that in an otherwise wage-led economy, a decrease in the wage share is associated with no change in the growth rate or even an increase in the growth rate if worker households increase their indebtedness to finance their consumption. The increase in the household debt-to-income ratio before the 2007–9 crisis seems to have played that role and mitigated the negative macroeconomic effects of the—by then—three-decades-long increase in inequality (see Nikiforos [2016a] and references therein). Similarly, in a wage-led economy in a period of household deleveraging, an increase in the wage share might have no effect on growth—or a decrease in the wage share might be associated with decreases in consumption and growth of a higher magnitude than if no deleveraging was taking place. Given that the household debt-to-income ratio has varied a lot over the period of our sample it is important to examine how sensitive the results are to it.

4.2.2. Including Labor Productivity as an Endogenous Variable

Lavoie (2014, 323–25) has suggested that the estimates in studies that have found profit-led regimes might be biased because they ignore the procyclical behavior of labor productivity—which in turn is the result of overhead labor. Since, by definition an increase in productivity leads (ceteris paribus) to an increase in the profit share, Lavoie argues that the procyclical tendency of the profit share to increase might be captured as a positive effect of increases in the profit share on

[5] Foreshadowing our results, when we use our preferred ordering, we find that the US economy became more profit-led in the first postwar decades until the 1970s, it then became progressively less profit-led since, and in the last fifteen years of our sample the cumulative effect of changes in distribution on economic activity is statistically insignificant. If output growth is ordered before the wage share, the median estimates show a neutral regime until the early 1960s, which then became progressively more wage led until the mid-1970s, it reverted to neutral by the mid-1980s and wage-led again afterwards. For most of the sample (except for the mid-1970s and the most recent fifteen years) the results of the second ordering are statistically insignificant.

[6] Goodwin (1967) is the most well-known formalization of the idea of profit squeeze with several more recent works building on it (Barbosa-Filho and Taylor 2006, Barrales-Ruiz et al. 2022). The effects of overhead labor on productivity and the wage share are discussed, among others, by Lavoie (2014, section 5.5) and Nikiforos (2017). For a methodological discussion of the different theories of distribution and what it means to be 'exogenous' or 'endogenous' to market forces, see Nikiforos (2021a).

[7] That is to say that models such as < wage →productivity→utilization> or <productivity→wage →utilization> are still liable to the same problem because of the effect of output on productivity (although they avoid the issue arising from the contemporaneous effect of productivity on the wage *share*).

macroeconomic activity.[8]

4.2.3. Including Government Deficit and Trade Balance

The effect of changes in distribution on growth might be reinforced, compensated or mitigated by fiscal spending or changes in net exports. The period under consideration saw significant changes and fluctuations in the trade balance and the government deficit, it is thus important to take them into account and see how and if they change our conclusions.

4.2.4. Substituting the Rate of Capacity Utilization for the Growth Rate as a Measure of Macroeconomic Activity

The baseline Kaleckian/Structuralist model uses capacity utilization as a measure of economic activity. Several important contributions discuss separately the effect of a change in distribution on utilization and the growth rate (e.g., Bhaduri and Marglin 1990; Kurz 1990). An important problem with the measures of utilization, which are available for a relatively long period of time and at a quarterly frequency, is that they are constructed in a way that assumes that capacity cannot diverge from output over the medium run. This is an issue with the data on capacity utilization published by the Federal Reserve (Nikiforos 2016c, 2021b), but also with the measure of the output gap, which uses the potential output published by the Congressional Budget Office (CBO) as a measure of capacity, and of course statistical measures of utilization that produce potential output using filters, such as the Hodrick-Prescott filter. Because of our methodology, this issue becomes more problematic compared to conventional VAR models. In our estimation we used the measure of the output gap as a proxy for the rate of utilization—for the reasons explained here, the related results should be interpreted with some caution.

In what follows we report the results of these four additional variations. While preparing this paper we ran several models that combined the aforementioned variations without any significant change in the results, and therefore we do not report them here.

4.3. Data

We used quarterly data for the US economy up to the last quarter of 2019. The data were retrieved from the Federal Reserve Economic Data (FRED) database on November 9, 2021. The series we used are originally published by the Bureau of Economic Analysis (BEA), the Bureau of Labor Statistics (BLS), and the Federal Reserve Board (FRB). More precisely we used the following series: (the FRED code is in parenthesis) [the date in the square brackets represent the first quarter the series is available for]. We calculated the growth rate of real GDP using "Real Gross Domestic Product" (GDPC1) [1947q1]. We used "Nonfarm Business Sector: Labor Share for All Employed Persons" (PRS85006173) [1947q1] as the wage share. The debt-to-income ratio of households was calculated as the ratio of "Households and Nonprofit Organizations; Total Liabilities, Level" (TLBSHNO) [1951q4] over "Disposable Personal Income" (DPI) [1947q1]. We calculated the growth rate of labor productivity based on "Nonfarm Business Sector: Labor Productivity (Output per Hour) for All Employed Persons" (OPHNFB) [1947q1]. The trade balance and government deficit as a percentage of GDP was calculated using "Net Exports of Goods and Services" (NETEXP) [1947q1] and "Net Lending or Net Borrowing (-), NIPAs: Government" (AD01RC1Q027SBEA) [1960q1], respectively, and dividing them by "Gross Domestic Product" (GDP) [1947q1]. Finally, as a measure of capacity utilization we used the output gap, defined as the ratio of real GDP (mentioned above) over "Real Potential Gross Domestic Product" (GDPPOT) [1949q1].

5. Results

In a regular VAR model, once the parameters are estimated, the usual way of visualizing the results is by plotting the impulse response functions (IRFs), which show how a shock to a certain variable affects some other (or the same) variable over time. In a TVP-SVAR, the parameters of the model change over time, and therefore so do the IRFs. One thus can present this time varying effect in two ways. First, they can plot the IRFs at different points in time and see if and how they have changed. For example, in our exercise we could plot the IRFs in 1950q1, 1975q1, 1990q1, and 2015q1 (or any other period we chose) and see if and how these IRFs differ.

Another way is to present the evolution of the IRFs over time at a certain time horizon. In this way, by combining plots of different time horizons one can see how the structure of the model has changed over time. For example, one can plot how a shock to a certain variable affects another variable contemporaneously (or after x periods of time) and how this effect changes over time. We chose to use this (the second) approach because it allows one to visualize the change in the structure of the model continuously over the time-period of the sample—albeit at the cost of presenting only a certain number of time horizons; obviously, the opposite is the case in the first approach.

The results of the baseline model are presented in Fig. 1. The figure presents the cumulative effect of a one-unit shock to the wage share on the growth rate at different frequencies: the contemporaneous effect (0 quarters) in subfigure (a) and the effects after one, three, six, nine, and twelve quarters in subfigures (b) to (f), respectively. All six subfigures present the posterior median of the parameters and the 68 percent equal-tailed point-wise posterior probability bands.[9] The subfigure at the bottom summarizes the results of the median at the various frequencies. To interpret the results, we should keep in mind that all variables have been standardized. We can summarize our findings as follows:

i) The growth rate of the US economy became more profit-led over the first postwar decades until the 1970s.
ii) The degree of profit-ledness has decreased starting in the late 1970s. The cumulative effect of changes in the wage share has been statistically insignificant (neither profit-led or wage-led) in the period after early 2000s.
iii) These changes in the regime of the US economy over time are substantial both in terms of the overall time period under examination and for the different subperiods. For example, our results show that the effect of income distribution on macroeconomic activity varied substantially even if we isolate subperiods such as "before 1970," "before or after 1980" etc. This highlights a limitation of the existing empirical literature that estimates

[8] There is some mixed empirical evidence regarding this hypothesis. Nogueira Rolim (2019) uses a VAR model and finds that a shock to the overall wage share has a negative effect on utilization. However, if the wages are decomposed into wages of workers and supervisory employees, a shock to the share of income of regular workers has a positive effect on utilization. As mentioned above, Cauvel (2022) examines it with a three-dimensional VAR model with real wage, utilization, labor productivity. He finds empirical support for it when productivity utilization is ordered before thw real wage, but not if ordered afterwards. Mendieta-Muñoz et al. (2022) do not find support even for the former ordering. Our study is not directly comparable to these earlier studies, as we use the overall wage share, and not the wage rate. Extensions along the lines suggested by the studies could be interesting paths for future research.

[9] The use of the 68 percent equal-tailed point-wise posterior probability bands is a conventional practice of Bayesian econometrics.

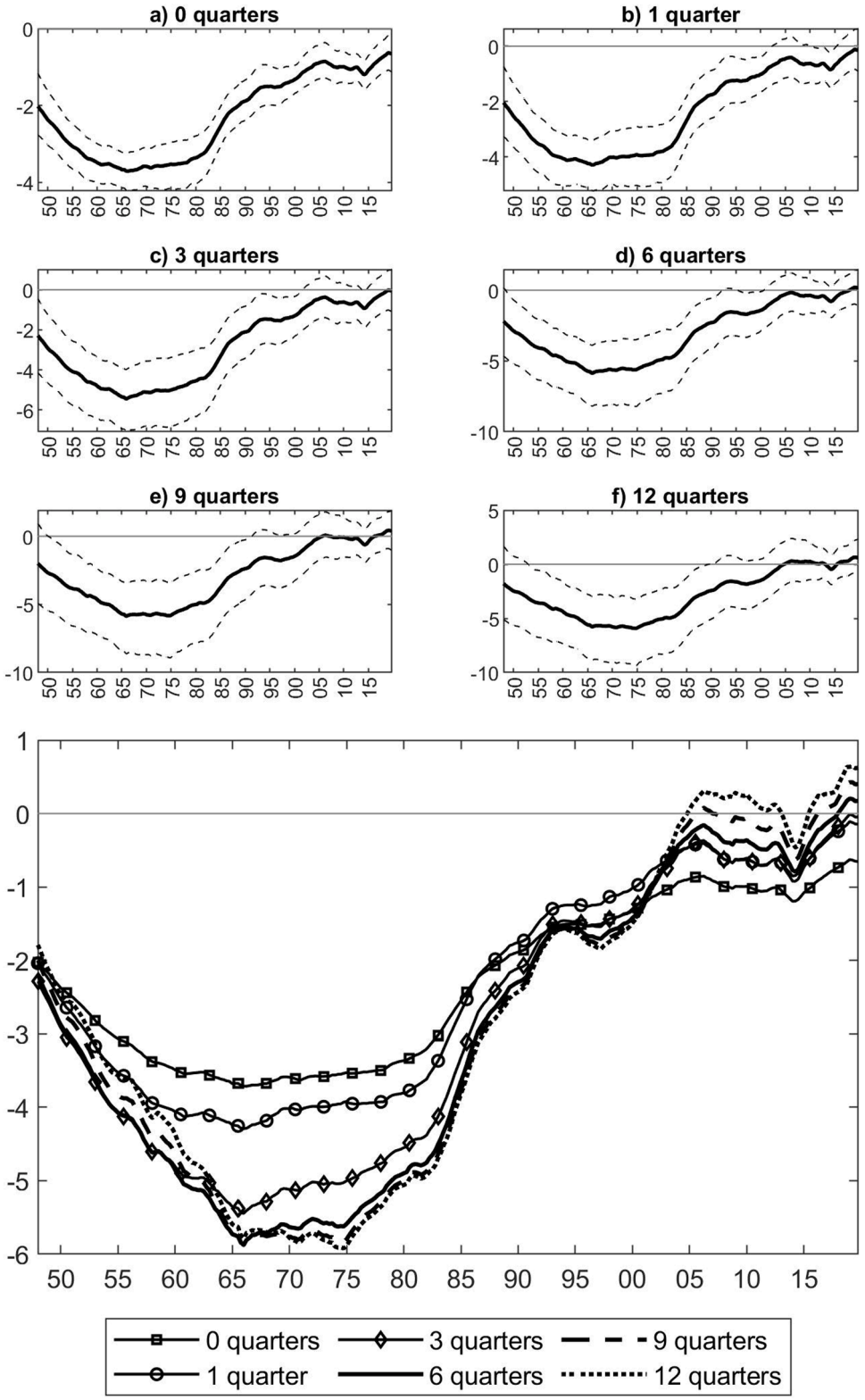

Fig. 1. Cumulative Time-Varying Effects of a Wage Share Shock on Real GDP Growth Rate at Different Horizons (1947–2019)—Baseline Specification: Wage Share, Real GDP Growth Rate.

Note: The solid line depicts the posterior point-wise median response of GDP. The dashed lines define the 68 percent equal-tailed point-wise posterior probability bands.

time variation of the regimes by splitting the overall sample into two subperiods (see the discussion in section 3).[10]

iv) In the first decades of the sample until the late 1990s, the cumulative effect becomes progressively more negative as the time horizon increases (the 0-quarters line is above the 1-quarter line which is above the 3-quarter line and so on). This pattern reverses over the last two decades of the sample (the 0-quarters line is now below the 1-quarter line which is below the 3-quarters line so on). This implies that the point estimates for higher time horizons are negative until the late 1990s but have become positive since.

v) Given the fact that income inequality started increasing in the second half of the 1970s, our findings are consistent with the hypothesis that an economy becomes more wage led as distribution becomes more unequal and vice versa (along the lines of Taylor [1990], Palley [2014] and Nikiforos [2016b, 2022]). Related to that, given that this is a period with an increasing financialization of the US economy, our findings are also consistent—at least to a certain extent—to the claim of Vasudevan (2017) that financialization increases the wage-led (or reduces the profit-led) tendencies of an economy.

vi) Findings (i) and (ii) above are also consistent with a long-run cyclical behavior in the degree of distribution-ledness as suggested in Nikiforos (2016b, 2022). The change in the direction of the distribution of the regime coincides with the crisis in the 1970s and the change in the direction of the distribution of income. Of course, given that our sample is short—relative to the long-run oscillations described in these articles, this conclusion should be interpreted with some caution.

The results of the additional model variations—presented in Figs. 2 through 5—have the same overall picture. Not surprisingly, adding more and relatively more-volatile variables makes the median response more volatile as well and, in some cases, widens the 68 percent probability bands. This, however, does not change the validity of the results. The inclusion of debt-to-disposable-income ratio and labor productivity does not make our estimates more wage-led. In the model that includes the government and trade balance, distribution-ledness converges toward zero slightly earlier compared to the other models. Finally, the model with the output gap also presents a broadly similar picture.

The results of the additional model variations are not sensitive to the ordering of the additional variables as long as the wage share comes before output. In other words, it does not matter if government and trade balance or household indebtedness are ordered before or after the wage share or output, as long as the wage share is ordered before output.

The exception to this is labor productivity: when it is ordered before the wage share the results change, and we find a neutral regime (neither wage-led or profit-led) for the entire sample. However, as we explained in section 4.1 such an ordering is not consistent with the classical theory of distribution. At the same time, we should repeat here the caveat discussed in section 4.1, namely that when productivity is ordered after the wage share, the contemporaneous effect that productivity has on the wage share is suppressed. This means that although the model captures part of the cyclical effect of changes in productivity on the wage share it doesn't fully address the issue raised by Lavoie (2014), because of the suppression of the contemporaneous effect. More research—probably with different methodologies—would be useful to examine this issue.

Finally, it is worth noting that the estimates themselves can become a valuable data series that could be used in empirical exercises where the—changing over time—demand regime plays a role.

6. Conclusion

This paper estimated the distribution-led regime of the US economy for the period 1947–2019. Our methodology was dictated by the concern that the regime of an economy might not remain stable over time. There are several reasons—logical, theoretical, empirical, and what we called history-of-economic-thought reasons—why the regime of an economy in general or the US economy in particular might have changed over the period under examination.

The existing empirical literature has mostly ignored the issue of the time variation of the regime, or in the best case has addressed it by splitting the overall sample into two subperiods (e.g., before and after 1980). However, for the same reasons a regime might change over the postwar period as a whole, it should change for a three- or four-decade subperiod.

For our purposes, we employ a TVP vector autoregressive model to estimate the (time-varying) effect of changes in distribution on macroeconomic activity. This is, to the best of our knowledge, the first attempt to estimate the regime of an economy while allowing for continuous changes in the regime itself over time.

We utilize various specifications, and we find that the effect of changes in income distribution on the rate of growth have changed significantly over the postwar period. More specifically we find that the US economy has become less profit-led over the last four decades, while in the first three postwar decades profit-ledness was increasing or remained roughly constant. These results are in line with theories of growth and distribution that emphasize the changing cyclical character of the distribution-led regime.

[10] As a point of reference, we also ran a "regular" SVAR model for the whole period of our sample, as well for the period before and after 1980. In line with much of the literature summarized in section 3 but also with our own results in this paper, we found a much more negative response of output to an increase in the wage share over the first period (ante 1980) compared to the second period (post 1980).

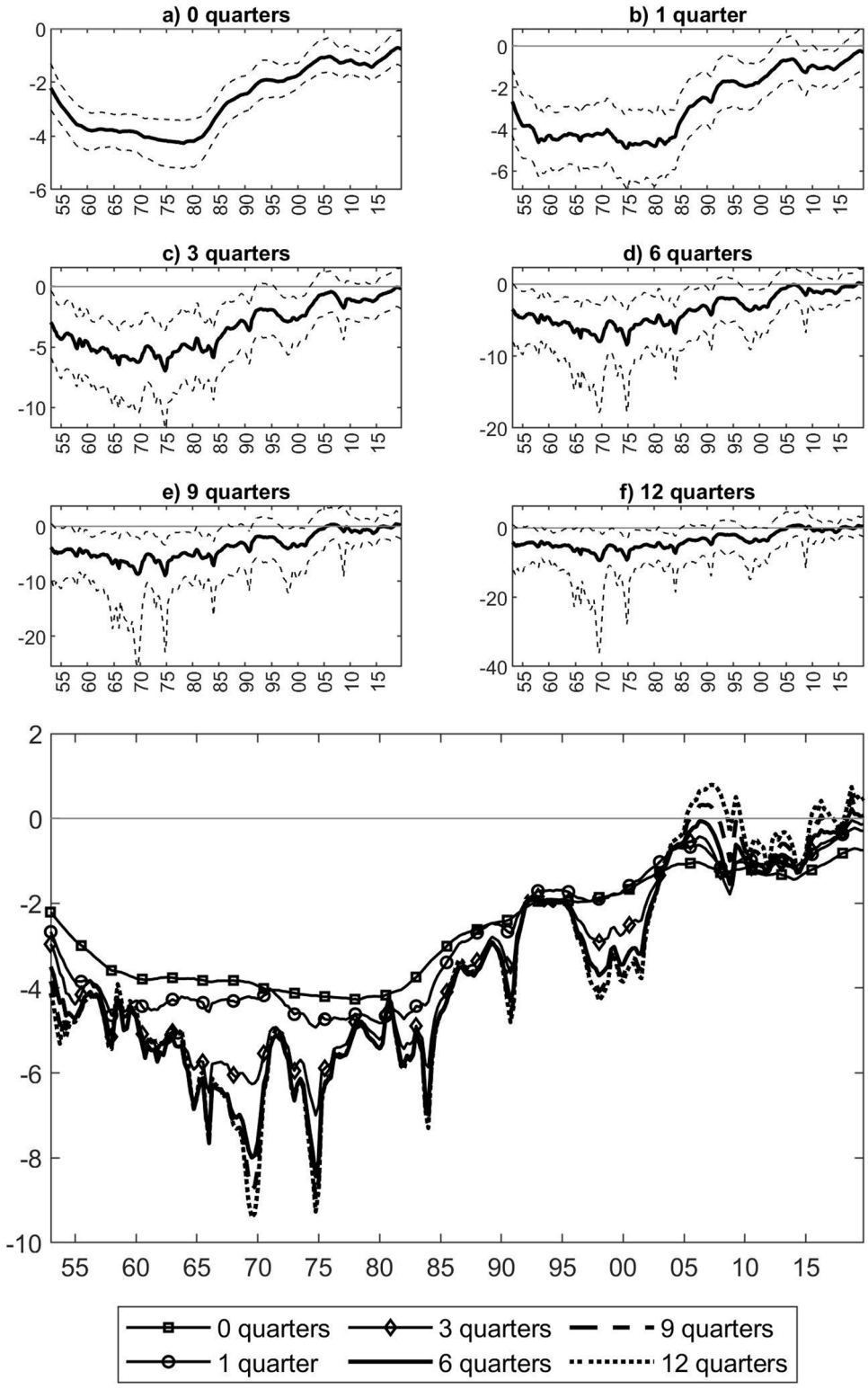

Fig. 2. Cumulative Time-Varying Effects of a Wage Share Shock on Real GDP Growth Rate at Different Horizons (1951–2019)—Specification: Wage Share, Growth Rate of Household Debt-to-Disposable-Income Ratio, Real GDP Growth Rate.
Note: The solid line depicts posterior point-wise median response of GDP. The dashed lines in sub-figure (a) define the 68 percent equal-tailed point-wise posterior probability bands.

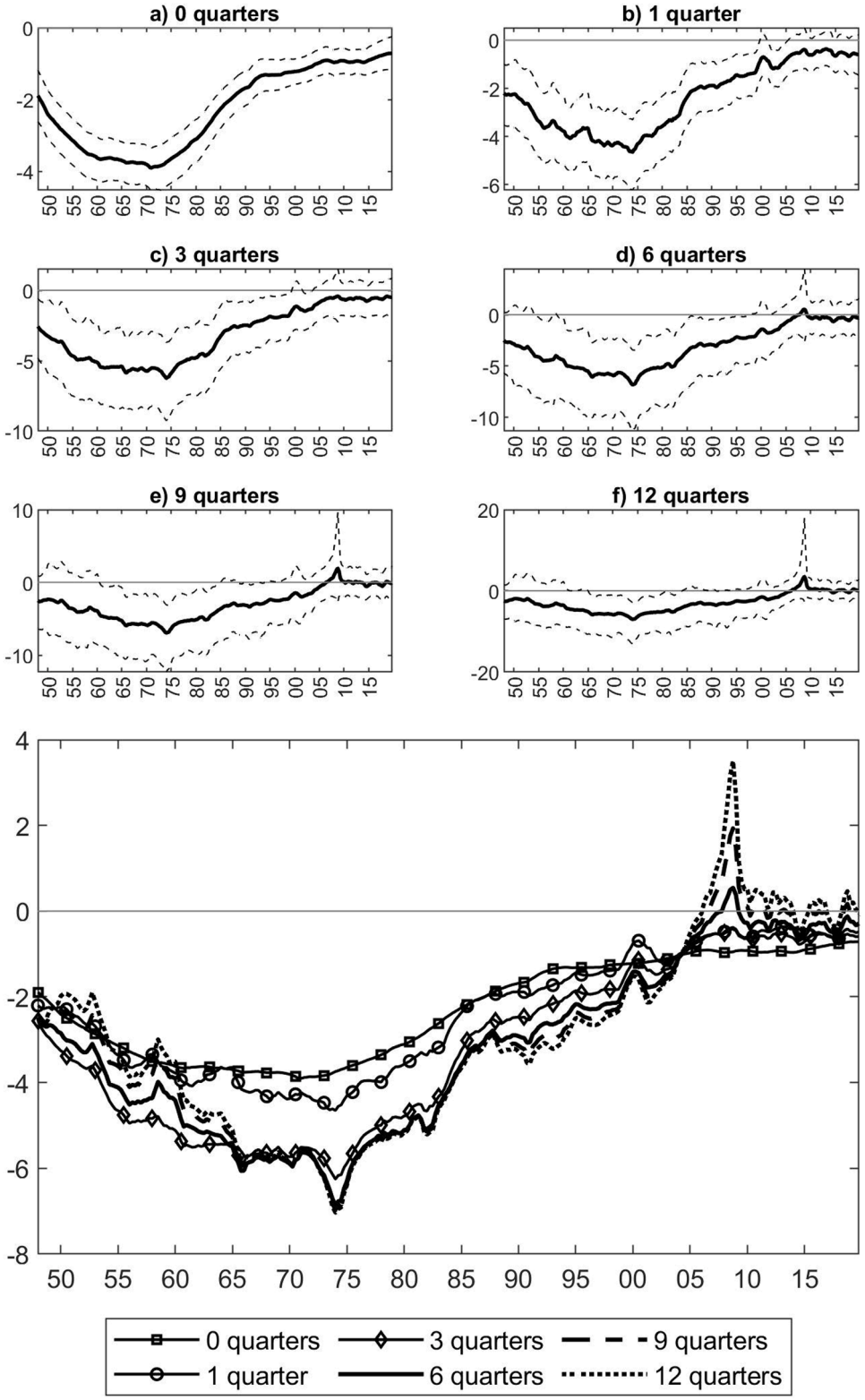

Fig. 3. Cumulative Time-Varying Effects of a Wage Share Shock on Real GDP Growth Rate at Different Horizons (1947–2019)—Specification: Wage Share, Productivity Growth Rate, Real GDP Growth Rate.
Note: The solid line depicts posterior point-wise median response of GDP. The dashed lines in sub-figure (a) define the 68 percent equal-tailed point-wise posterior probability bands.

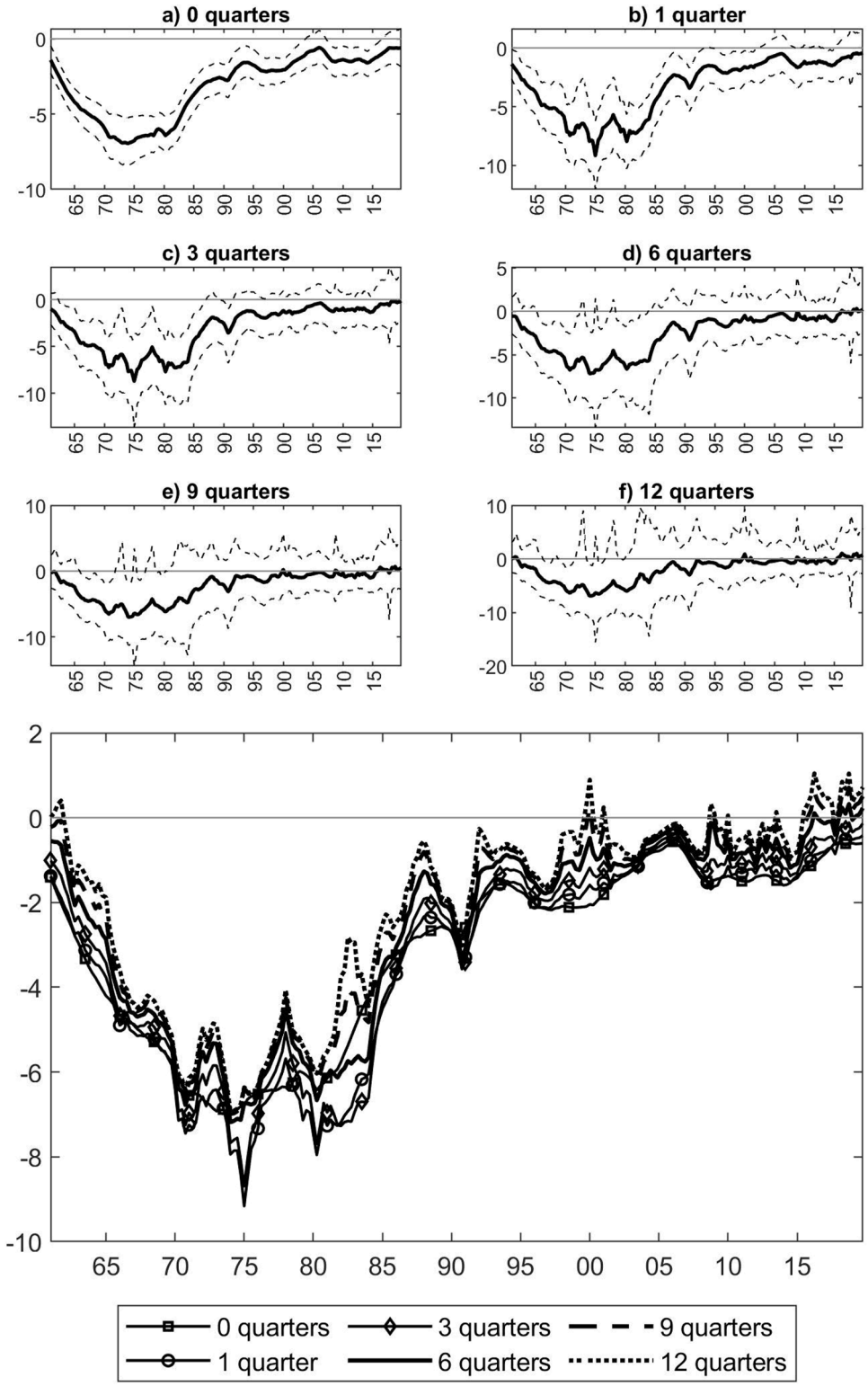

Fig. 4. Cumulative Time-Varying Effects of a Wage Share Shock on Real GDP Growth Rate at Different Horizons (1960–2019)—Specification: Wage Share, Trade Balance, Government Balance, Real GDP Growth Rate.

Note: The solid line depicts posterior point-wise median response of GDP. The dashed lines in sub-figure (a) define the 68 percent equal-tailed point-wise posterior probability bands.

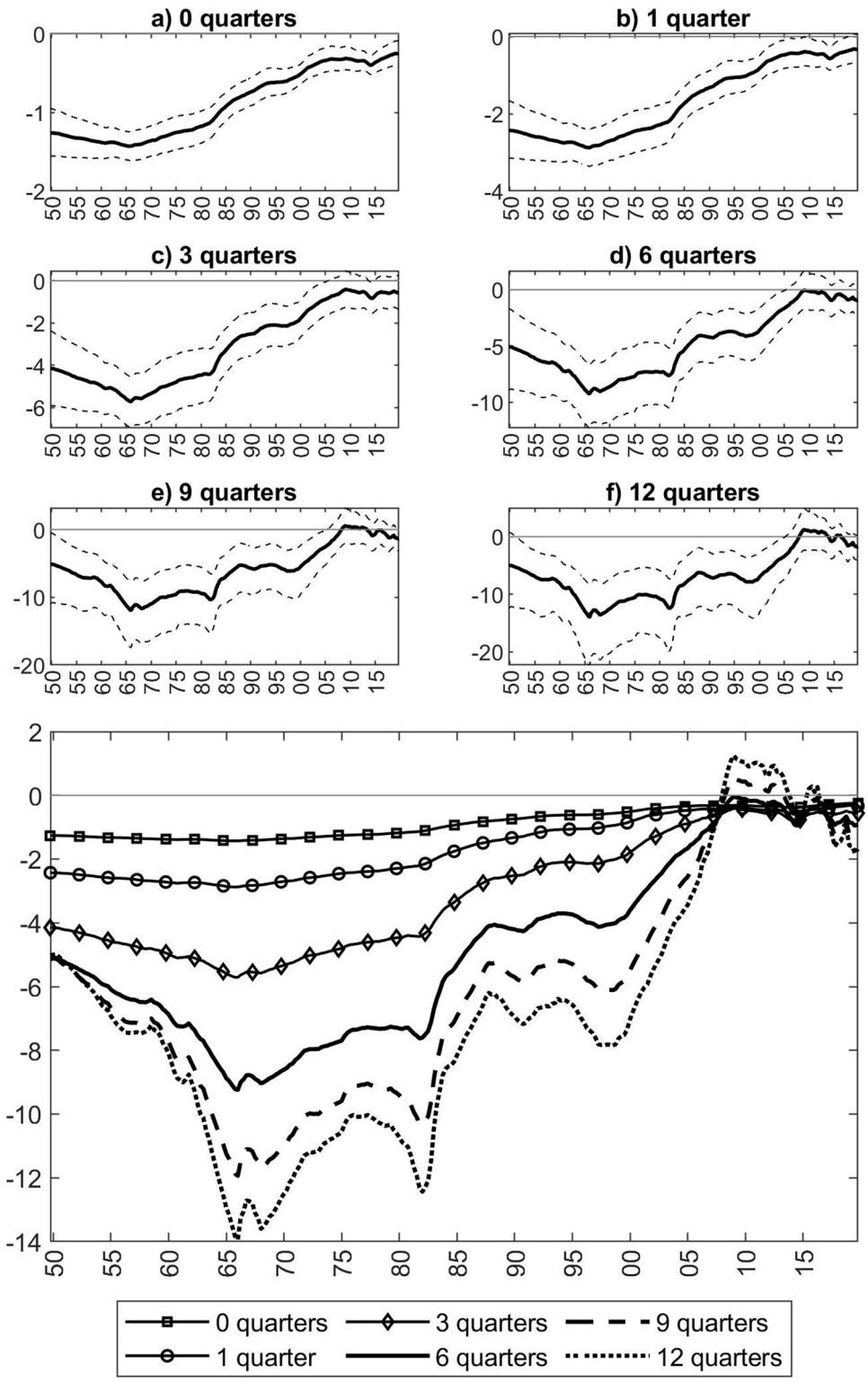

Fig. 5. Cumulative Time-Varying Effects of a Wage Share Shock on Output Gap at Different Horizons (1949–2019)—Specification: Wage Share, Output Gap.
Note: The solid line depicts posterior point-wise median response of GDP. The dashed lines in sub-figure (a) define the 68 percent equal-tailed point-wise posterior probability bands.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

We have used public data. Details are provided in the paper (section 4.2).

Acknowledgments

Two anonymous referees provided suggestions which led to a substantial improvement of this article. For useful discussions, comments, and suggestions we would also like to thank Nelson Barbosa, Robert Blecker, Laura Carvalho, Amitava Dutt, Daniele Girardi, Marc Lavoie, Stephen Marglin, Özlem Onaran, Peter Skott, Tom Palley, Englebert Stockhammer, Lance Taylor, Lorenzo Tonni, Leonardo Vera, Rudi von Arnim, as well as participants in the 25th FMM conference in Berlin and the 34th EAEPE conference in Naples. The usual disclaimer applies

Appendix: Time-Varying Parameters SVAR

A. Model

Following Primiceri (2005), Nakajima (2011), and Koop and Korobilis (2010), we considered a time-varying parameter structural vector autoregressive (TVP-SVAR) model as

$$A_{0,t}Y_t = \sum_{l=1}^{p} A_{l,t}Y_{t-l} + D_t\varepsilon_t, \text{ for } 1 \le t \le T$$

where Y_t is the n $\times$ 1 vector of the endogenous variables, $A_{j,t}$ is $n \times n$ matrix of structural parameters for $j = 0, \ldots, p$ that vary over time, D_t is $n \times n$ diagonal matrix of standard deviation ($\sigma_{j,t}$) that varies over time, ϵ_t is the n $\times$ 1 vector of structural shocks with mean zero and variance I ($\epsilon \sim \mathcal{N}(0, I)$), n is the number of endogenous variables, p is the number of lags, and T is the sample size. Note that A_0 is the lower triangular matrix and D is the diagonal matrix as:

$$A_{0,t} = \begin{bmatrix} 1 & 0 & \ldots & 0 \\ a_{21,t} & 1 & \ldots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1,t} & a_{n2,t} & \ldots & 1 \end{bmatrix} \quad D_t = \begin{bmatrix} \sigma_{1,t} & 0 & \ldots & 0 \\ 0 & \sigma_{2,t} & \ldots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \ldots & \sigma_{n,t} \end{bmatrix}$$

The structural parameters are meant to capture time variation in the contemporaneous relationship and the lag structure of the model. The degree and the direction of this variation is determined by the data. Like Primiceri (2005), Nakajima (2011), and Koop and Korobilis (2010), we implemented the following process for time-varying parameters (state variables):

$$\alpha_t = \alpha_{t-1} + \eta_t$$

$$B_t = B_{t-1} + \nu_t$$

$$\log\sigma_t = \log\sigma_{t-1} + \xi_t$$

where α_t is the vector of non-zero and non-one elements of the matrix $A_{0,t}$ (stacked by rows), B_t is the vector that results from stacking the matrices $A_{l,t}$ for $l = 1 \ldots p$, and σ_t is the vector of the diagonal elements of D_t.

We also assumed that the innovations components of the model have a jointly normal independent and identical distribution with the variance-covariance matrix as:

$$V = Var\left(\begin{bmatrix} \varepsilon_t \\ \eta_t \\ \nu_t \\ \xi_t \end{bmatrix}\right) = \begin{bmatrix} I_n & 0 & 0 & 0 \\ 0 & Q & 0 & 0 \\ 0 & 0 & S & 0 \\ 0 & 0 & 0 & W \end{bmatrix}$$

where I_n is $n \times n$ identity matrix, and Q, S, and W are positive definite matrices. We implemented the TVP-SVAR with independent innovations.

B. Estimation Method

We estimated the model using the standard method with the Kalman filter and Bayesian inference. We do not describe here the mathematical process but present the algorithm to estimate this state-space model. One can review Kim and Nelson (1999), Primiceri (2005), Nakajima (2011), and Koop and Korobilis (2010) for more details.

We estimated the model with Bayesian methods that allow obtaining the distribution of the unknown parameters by algorithms of simulation. We used the Markov chain Monte Carlo (MCMC) algorithms to exploit the blocking structure of state-space form (Kim and Nelson 1999). Conditional on observed data and prior hyperparameters, we implemented the Gibbs sample in four steps:

- Conditional on $A_{0,t}$, D_t, and V_t, the posterior distribution of B_t can be drawn using the standard Kalman filter.
- Conditional on B_t, D_t, and V_t, the posterior distribution of $A_{0,t}$ is a product of normal (Gaussian) densities and can be drawn with a standard smoother.
- Conditional on $A_{0,t}$, B_t, and V_t, the posterior distribution of D_t can be drawn transforming a nonlinear and non-Gaussian state-space representation in a linear and approximately normal model, allowing use the standard simulation smoothers.
- Conditional on $A_{0,t}$, B_t, and D_t, V_t was simulated as the product of independent inverse-Wishart distributions.

Bayesian methods use informative prior information for the estimation of the related models. Following Koop and Korobilis (2010), we used partial information priors to set the initial values:

$$B \sim \mathcal{N}(0, I)$$

$$A_0 \sim \mathcal{N}(0, I)$$

$$D \sim \mathcal{N}(0, I)$$

$$Q \sim \mathcal{IW}\left(k_Q^2 * I, n+1\right)$$

$$S \sim \mathcal{IW}\left(k_S^2 * I, n+1\right)$$

$$W \sim \mathcal{IW}\left(k_W^2 * I, n+1\right)$$

The dimensions of the identity matrix I depend on the rank of the matrices. We also set $k_Q = 0.01$, $k_S = 0.01$ and $k_W = 0.01$ to obtain our results.[11]

We ran 12,000 draws to estimate the conditional posterior distribution of the parameters. To mitigate the initial values, we discarded 2,000 draws ("burn-in" simulations). We also experimented with a higher number of draws—up to 100,00—but our results do not change in any meaningful way. Finally, we present the posterior median of the parameters and the 68 percent equal-tailed point-wise posterior probability bands.

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[11] We also implemented ordinary least square and noninformative prior, but the results are similar.