Department of Economics - FEA/USP

Knowledge Capital Accumulation, Household Student Debt, and the Labor Share in the Social Product: Evidence for the United States

MARINA DA SILVA SANCHES

GUSTAVO PEREIRA SERRA

GILBERTO TADEU LIMA

WORKING PAPER SERIES Nº 2026-03

DEPARTMENT OF ECONOMICS, FEA-USP
WORKING PAPER Nº 2026-03

Knowledge Capital Accumulation, Household Student Debt, and the Labor Share in the Social Product: Evidence for the United States

Marina da Silva Sanches (marinasanchess.unb@gmail.com)

Gustavo Pereira Serra (g.serra@unesp.br)

Gilberto Tadeu Lima (giltadeu@usp.br)

Abstract:

This paper analyzes the dynamic relationships among knowledge capital accumulation (measured by the share of the population completing college) household student indebtedness, and the functional distribution of income between labor and non-labor in the U.S. over the period 2003-2019. Drawing on the Neo-Kaleckian demand-led framework in the Cambridge, U. K. tradition, it tests the hypotheses that rising student debt exerts downward pressure on labor income, while knowledge capital accumulation mitigates this effect. Despite an expanding theoretical literature, empirical evidence on these dynamic interactions remains severely limited. Using a Vector Autoregression (VAR) framework, the study finds that increases in student debt reduce the labor share primarily through lower real wages, with no significant effect on labor productivity. In contrast, knowledge capital accumulation increases the labor share and contributes to a reduction in student debt. Overall, the results underscore that real wage and labor share determination is shaped by institutional and conflict-distributional factors, thereby supporting policy measures aimed at reducing household student indebtedness, strengthening collective bargaining, and expanding publicly funded education.

Keywords: Knowledge capital accumulation; student debt; functional distribution of income; workers` bargaining power.

JEL Codes: C32, E24, E25.

Knowledge Capital Accumulation, Household Student Debt, and the Labor Share in the Social Product: Evidence for the United States

Marina da Silva Sanches
Research Center on Macroeconomics of Inequalities (Made/FEA)
University of São Paulo
marinasanchess.unb@gmail.com

Gustavo Pereira Serra
São Paulo State University (UNESP)
g.serra@unesp.br

Gilberto Tadeu Lima
Department of Economics and Research Center on Macroeconomics of Inequalities (Made/FEA)
University of São Paulo
giltadeu@usp.br

February 2026

1. Introduction

Between 2003 and 2019, the U.S. economy continued the long-term decline in the labor share in income observed since the early 1980s (Cauvel and Pacitti, 2022; Guschanski and Onaran, 2021). Over this period, labor compensation and productivity became increasingly decoupled, with the labor share in income falling by approximately 3.9%, from 0.621 in 2003 to 0.597 in 2019, and exhibiting a particularly pronounced decline in the aftermath of the 2008 financial crisis. In parallel, outstanding student debt increased from about US$0.33 trillion in 2003 to nearly US$1.45 trillion by the end of 2019—an expansion of roughly 340%, implying that it more than quadrupled in less than two decades. In fact, by the end of 2019 student loan debt had already become the second-largest category of household debt in the U.S., surpassed only by mortgage debt, and exceeding the aggregate balances of both auto loans and credit card debt. Total household debt also rose by approximately 37% over the same period (FRBNY, 2025). Taken together, these developments are indicative of potential structural changes in the distribution of the social product between labor income and non-labor income, as well as of an increasing reliance on credit—particularly educational debt—to support not only household consumption but also access to essential goods and long-term investments such as housing and knowledge capital accumulation through education.

From a mainstream microeconomic perspective, the rationale for student loans is straightforward: individuals facing liquidity constraints may borrow to finance college education when the expected wage premium exceeds its cost. Investment in higher education increases knowledge capital, enhances labor productivity, and, consequently, raises expected earnings (Friedman, 1955; Lochner and Monge-Naranjo, 2011). However, this reasoning rests on two key assumptions: (i) that labor productivity arising from knowledge capital accumulation is automatically translated into higher wages, and (ii) that the available knowledge capital stock is fully employed.[1]

Empirical evidence challenges both premises. First, the persistent and widening gap between labor productivity growth and real wage increases has been documented in the U.S. since the 1980s (Shaikh, 2016). Second, despite the continued existence of a college wage premium, unemployment remains a structural issue, even among college graduates (Abel and Deitz, 2014; Abel et al., 2014). Questioning these assumptions underscores the need for an analytical framework that accommodates involuntary unemployment and the possibility that workers not fully appropriate labor productivity gains accruing from knowledge capital accumulation.

Recent demand-led macroeconomic approaches in the Cambridge, U. K. tradition offer valuable insights in this context. Within a distributional class-conflict framework drawing on the seminal contribution by Rowthorn (1977), for example, the relative bargaining power of workers and capitalists determines the extent to which labor productivity gains are transmitted to wages (Lima et al., 2021). Moreover, although debt-financed knowledge capital accumulation enhances labor productivity, the associated household indebtedness may ultimately weaken workers' bargaining position in wage negotiations, resulting in lower labor income and, consequently, weaker aggregate demand and employment (Serra et al., 2025)—an outcome that contrasts with conventional mainstream analyses.

Despite an extensive theoretical literature on knowledge capital accumulation, student indebtedness, and the distribution of the social product (Lima et al., 2021; Carvalho et al., 2024; Serra et al., 2025; Serra, 2023; Serra, 2025), empirical evidence on the dynamic interactions among these variables remains limited. This paper contributes to filling this gap by providing empirical estimates of these relationships using U.S. data for the period 2003-2019, thereby testing theoretical predictions that have previously been examined only conceptually and theoretically. In doing so, the study illuminates the complex links involving knowledge capital accumulation, student debt, and the distribution of the social product, while decomposing the labor share in income into its labor productivity and real wage components, allowing for a finer-grained and more precise understanding of how each component shapes the observed conflict-distributional dynamics.

Methodologically, the study employs a Vector Autoregression (VAR) framework to capture these complex interactions and identify the main underlying transmission channels and mechanisms. The results indicate that increases in student debt significantly reduces the labor share, primarily through declines in real wages, while labor productivity remains unaffected. By contrast, knowledge capital accumulation exerts a positive effect on the labor share in social product and contributes to a reduction in student debt, although the underlying channels

[1] As Bowles and Gintis (1975) observe in their pioneering study, the "justification for the expression 'human capital' is the fact that skills, like other assets, constitute a claim on future income" (p. 79). For a comprehensive critique of the individualistic methodology underlying mainstream human capital theory, as well as for alternative approaches to the economic analysis of education, see Auerbach and Green (2025).

differ across time horizons. Meanwhile, gains in labor productivity tend to increase student debt and do not translate into higher real wages, pointing to a structural decoupling between productivity and labor compensation.

These findings underscore that real wage and labor share determination depends primarily on institutional and distributional factors inherently rooted in class conflict. The resulting policy implications highlight the importance of reducing household student indebtedness, expanding publicly funded education, and strengthening collective bargaining—and thus workers' bargaining capacity to claim and obtain a share in the social product as key elements in promoting sustainable economic growth, macroeconomic stability, and a more equitable functional distribution of income.

This paper is organized as follows. Following this introduction, Sections 2 and 3 briefly review the theoretical and empirical literature that motivates and frames the analysis. Section 4 describes the data and the econometric methodology employed in the estimation. Section 5 presents and discusses the main empirical results, while Section 6 draws out the broader political economy implications of the findings. Section 7 discusses some robustness tests and Section 8 offers concluding remarks.

2. Empirical evidence and motivation

According to the seminal contributions of Becker (1964) and Mincer (1958) in the human capital literature, higher levels of schooling are associated with greater expected earnings. Empirical evidence supports this relationship: although the magnitude of returns has declined in recent decades, the college wage premium remains positive in the U.S. (Ashworth and Ransom, 2019). For example, at the end of 2024 the unemployment rate was 4.0% for the overall labor force, compared with 2.6% among college graduates. During the same period, median annual earnings for workers holding a bachelor's degree were approximately $60,000—about $20,000 higher than for those with only a high school diploma.[2]

Nonetheless, Athreya and Eberly (2021) show that, despite positive expected returns, investment in college education remains relatively low. They argue that college attainment is largely unresponsive to changes in the college wage premium, a finding that may be attributable to uncertainty surrounding earnings returns. For example, individual characteristics, institutional quality, and the design of student loan repayment plans can all affect whether such investments ultimately yield positive outcomes (Barrow and Malamud, 2015; Fu et al., 2025). In addition, labor market conditions play a critical role: graduates who enter the job market during downturns tend to suffer persistent earnings losses that can last up to a decade (Oreopoulos et al., 2012).

The risks associated with investment in higher education are also related to the likelihood of underemployment, or overeducation (Abel and Deitz, 2014; Abel et al., 2014). A substantial body of research documents the persistence of overeducation across countries. For example, using data on graduates in the UK in 1980, Dolton and Vignoles (2000) report that 38% of graduates held jobs that did not match their skill level in their first employment, and 30% remained overeducated six years later. Similarly, analyzing data on 28 European countries, Davia et al. (2017) conclude that—contrary to predictions from neoclassical human capital models—overeducation is not merely a transitory condition affecting recent graduates but rather a persistent feature of labor markets.

A number of studies document increases in overeducation during periods of contractionary fiscal policy (for example, in the U.S. between 1960 and 1976; Rumberger, 1981), during economic recessions (Kiersztyn, 2013), and in contexts of rising unemployment rates (Verhaest and Van der Velden, 2013). However, the causal relationship between restrictive demand-side policies and the excess supply of skilled workers remains insufficiently explored. This gap may help explain why policy recommendations in this literature tend to emphasize labor market regulation (Tsang and Levin, 1985; Davia et al., 2017), improved alignment between educational systems and labor market needs (Kupets, 2016; Davia et al., 2017), or even reductions in public investment in education (Rumberger, 1981). By contrast, scholars such as Amsden (2010) and Lima et al. (2021) argue in favor of demand-enhancing policies to mitigate the consequences of excess supply of skilled labor, contending that improvements in workers' knowledge skills alone may be insufficient to increase employment in the absence of aggregate demand policies that stimulate labor demand.

[2] Source: U.S. Census Bureau and U.S. Bureau of Labor Statistics, Current Population Survey (IPUMS): https://www.newyorkfed.org/research/college-labor-market#--:explore:wages

Despite the risks involved, some studies conclude that debt-financed investment in higher education continues to generate net benefits, with no detrimental effects on the repayment of other forms of debt (Black et al., 2023). From this perspective, household borrowing plays a positive role in the accumulation of human or knowledge capital accumulation and in fostering higher earnings. However, other scholars offer a contrasting interpretation, arguing that declining labor income—particularly in the U.S. since the 1980s—has contributed to rising household indebtedness, which has been used to sustain aggregate demand in the context of stagnant wages (Barba and Pivetti, 2009; Constantini and Seccareccia, 2020). In addition, Pinto and Steinbaum (2021) show that indebted workers tend to experience poorer labor market outcomes, a pattern that intensified during the Great Recession. Accordingly, the literature presents divergent views on the relationship between household borrowing and labor income. The following section outlines the theoretical perspectives that help reconcile these empirical findings and further motivate our analysis.

3. Related literature

The Neo-Kaleckian growth literature—and demand-led growth models more generally—largely neglected for quite some time the role of knowledge capital accumulation (or, in a narrower sense, human capital) in economic dynamics. As noted by Lima et al. (2021), this omission contrasts with the emphasis placed by Keynesian scholars within the Cambridge, U.K. tradition such as Roy Harrod, and Kaleckian scholars such as Josef Steindl, on the availability of a qualified labor force, which they regarded a central constraint on investment and economic growth. More recently, however, a number of demand-led theoretical contributions have examined the dynamic relationship involving knowledge capital accumulation, household student indebtedness, and the distribution of the social product between labor and non-labor income categories. In particular, Lima et al. (2021), drawing on Rowthorn (1977), incorporate the accumulation of knowledge capital—financed through universal public education—into a demand-driven growth model characterized by distributive conflict over the functional distribution of available income between labor and non-labor income recipients. Within their framework, knowledge capital accumulation enhances workers' productivity and bargaining power; however, as with any other form of productive capacity, an increased supply of skilled labor does not automatically generate its own demand.

Carvalho et al. (2024) extend this discussion by modeling knowledge capital formation financed through household debt within a demand-led macrodynamic framework. Their analysis highlights a "paradox of debt repayment," whereby allocating a larger share of wage income to debt service can, counterintuitively, increase household indebtedness. Building on these contributions, Serra et al. (2025) develop a modeling framework that integrates distributive conflict over available income, as in Lima et al. (2021), with debt-financed knowledge capital accumulation, as in Carvalho et al. (2024). They show that higher labor income shares stimulate economic activity in the short run, whereas in the unique and stable long-run equilibrium configuration, policies or structural changes that raise aggregate demand or enhance workers' bargaining power in wage negotiations increase the labor income share and reduce household indebtedness—except in cases where the positive effect of expected real wages on knowledge investment is sufficiently strong to outweigh other effects. Notably, while investment in knowledge capital accumulation boosts the level of economic activity in the short run, it does not necessarily increase the labor income share or sustain the same positive effects in the long run.

Empirical studies complement these theoretical insights by demonstrating how household debt constrains working households' behavior in the labor market. Wong et al. (2025) find that higher household indebtedness reduces the likelihood of unionized employment in the U.S., as financially constrained workers avoid union jobs due to perceived risks, including outsourcing as a cost-cutting measure. Similarly, in a theoretical demand-led modeling framework, Kim et al. (2019) show that household debt weakens workers' bargaining power in wage negotiations by increasing the perceived cost of job loss, since indebted workers fear not only being unable to service or roll over existing debts if unemployed, but also being unable to obtain new credit. Together, these empirical findings illustrate how financial vulnerability shapes working households' behavior in the labor market, linking household balance sheets to collective wage bargaining outcomes in complex ways (Gouzoulis, 2024).

The demand-led macrodynamic literature that incorporates household indebtedness highlights the ambivalent nature of credit (Dutt, 2006; Palley, 1994; Hein, 2011; Palley, 2010; Isaac & Kim, 2013). These modeling frameworks demonstrate that rising household indebtedness produces mixed effects: on the one hand, it stimulates aggregate demand by increasing household consumption; on the other, interest payments to capitalists—who have a lower propensity to consume—can dampen aggregate demand, potentially generating long-run instability and adverse implications for economic growth through the distributive channel, i.e., the distribution of the social product between labor and non-labor income categories.

4. Data and Methodology

4.1. Data

We employ data from 2003 to 2019, based on their availability, as described below (Table 1).

Table 1: Variables used in the study

Variable	Description	Source
Knowledge capital	Percentage of people 25 years and over who completed 4 years of college or more.	United States Census Bureau - CPS Historical Time Series Tables (Table A-2).[3]
Knowledge capital (robustness test)	Average number of years adults aged 25 and older have spent in formal education.	Our World in Data.[4]
Student debt	Student loan, deflated by CPI index (2017 prices).	Quarterly Report on Household Debt and Credit - Federal Reserve Bank of New York.[5]
Labor share	Labor share in income.	Extended Penn World Tables 7.0 (Marquetti et al. 2021).[6]
Labor productivity	Labor productivity at constant 2017 national prices.	Extended Penn World Tables 7.0 (Marquetti et al. 2021).
Real wages	Average real wage at constant 2017 national prices.	Extended Penn World Tables 7.0 (Marquetti et al. 2021).

Source: Authors' elaboration.

The only selected variable available at a quarterly frequency is student debt. All other variables were disaggregated from annual to quarterly frequency using the Denton-Cholette method. This procedure preserves the underlying annual trends while generating higher-frequency data, which is essential for the analysis, as estimating the model solely with annual observations would yield a sample size insufficient to reliably capture short-run dynamics.

4.2. Methodology

Vector Autoregression (VAR) models provide a flexible framework for analyzing the dynamic interactions among multiple time series variables without imposing strong a priori restrictions on their causal structure. Each variable in the system is modeled as a function of its own lagged values and the lagged values of the other variables, thereby allowing the temporal propagation of shocks throughout the system to be traced (Lutkepohl, 2005). This approach is particularly suitable for the present study, which examines the dynamic interrelationships involving knowledge capital accumulation (measured by the percentage of people who completed college), student debt, and the distribution of the social product. Given the potential reciprocal feedback among these variables, a VAR specification is more appropriate than a single-equation modeling framework.

An important advantage of the VAR methodology is its capacity to accommodate bidirectional causality among variables, thereby capturing feedback effects without imposing a priori assumptions about the

[3] https://www.census.gov/data/tables/time-series/demo/educational-attainment/cps-historical-time-series.html
[4] https://ourworldindata.org/grapher/average-years-of-schooling
[5] https://www.newyorkfed.org/microeconomics/hhdc
[6] https://people.umass.edu/dbasu/data.html

direction of causality (Barbosa Filho & Taylor, 2006; Carvalho & Rezai, 2015; Cauvel, 2023; Lima & Marques, 2025). This feature is particularly relevant for the present analysis, as demand-led models of knowledge capital accumulation emphasize the mutual interactions among the functional distribution of the social product between labor and non-labor income recipients, knowledge capital accumulation, and household indebtedness (Lima et al., 2021; Serra et al., 2025). Moreover, this approach is consistent with the Neo-Kaleckian literature in the Cambridge, U.K. tradition, which highlights the relationship between the functional distribution of the social product and aggregate demand formation. Employing a VAR framework therefore enables an empirical examination of these dynamic interdependencies in a theoretically grounded manner.

The baseline VAR includes knowledge capital, student debt, and the labor share in income, capturing the interaction involving knowledge capital accumulation, educational borrowing, and income distribution. To further disentangle the underlying mechanisms, two complementary specifications are estimated: in one, the labor share is replaced by labor productivity, with the real wage included as a control variable; in the other, the labor share is replaced by the real wage, with labor productivity controlled for. All variables were seasonally adjusted, expressed in logarithms, and found to be integrated of order one; accordingly, they enter the model in first differences.

We estimate a trivariate VAR model with two lags, as indicated by the Schwarz (BIC) and Hannan-Quinn (HQ) information criteria. The system is dynamically stable, with all characteristic roots lying inside the unit circle. Diagnostic tests support the adequacy of the specification: the Ljung-Box test indicates no residual autocorrelation, and the Breusch-Pagan test supports the assumption of homoskedasticity in the baseline specification that includes the labor share. When the model is disaggregated into real wages and labor productivity, a mild indication of heteroskedasticity emerges in one of the equations. This potentially problematic issue is addressed by employing bootstrap confidence intervals at the 90% level.

We compute impulse response functions (IRFs), which illustrate how a variable—or a set of variables—in a dynamic model responds over time to a shock to one of the model's variables. Specifically, an IRF traces the effect of a one-time, unit-sized shock to one variable on all variables in the system over subsequent periods. Given that the data are quarterly, each period in the IRF corresponds to one quarter following the shock.

The Cholesky ordering adopted is knowledge capital (measured by the percentage of people who completed college), student debt, and labor share (or its components in the disaggregated specifications), arranged from the most to the least exogenous variable. This identification strategy follows the theoretical framework proposed by Serra et al. (2025), in which knowledge capital accumulation is considered a relatively autonomous process that influences student debt dynamics and, ultimately, how the social product is distributed between labor and non-labor income recipients. Consequently, the labor share responds contemporaneously to shocks in knowledge capital and student debt, but not vice versa.

Overall, the diagnostic evidence indicates that the VAR model is appropriately specified, and the qualitative patterns of the impulse responses are both statistically robust and economically meaningful.[7] It is important to note, however, that when we analyze the labor share decomposed into real wages and labor productivity, these components refer to the entire workforce, not only to those who are or will become indebted to accumulate knowledge capital.

5. Results

First, the results on the labor share indicate that an increase in student debt has a negative effect on the labor share (Figure 1, panel (a)). The magnitude of this effect is modest, though: a 1% increase in debt reduces the labor share by 0.05% in the medium run, after sixteen periods[8]. The decomposition of this result shows that the effect operates through real wages, whereas labor productivity is not directly affected (Figure 4, panel (a), and Figure 1, panel (c), respectively). It is important to note that the small magnitude of the effect does not imply limited relevance, since the dynamics of the labor share is influenced by multiple factors, some of which mutually interact with and influence one another over time. Moreover, given the substantial rise in student debt over the period analyzed, even a relatively small effect can translate into a sizable absolute impact when applied to such a large change.

[7] The Shapiro test indicates a deviation from residual normality; however, achieving exact normality in short-run macroeconomic time series is inherently difficult, particularly with smaller samples. According to the Law of Large Numbers, as the sample size increases, the sample mean converges to the population mean, and the distribution of the error term tends to approximate normality (Brenck, 2021; Sanches et al., 2025).
[8] The magnitude of the effect is computed as the ratio of the impulse response function of the variable of interest to the impulse response function of the variable that generates the shock.

This finding can be related to the contribution of Serra et al. (2025), who model a negative relationship between the ratio of student debt to knowledge capital, and real wage growth. It is also consistent with Kim et al. (2019), who formally show that household indebtedness weakens workers' wage bargaining power in wage negotiations by increasing the perceived cost of job loss, as indebted workers fear being unable to service or roll over their debts, or to obtain new credit, in the event of unemployment, given that employment effectively serves as collateral for borrowing. Another possible explanation for this result, as discussed in Section 3, concerns the negative effects of household debt—specifically student debt in this context—on unionization and collective bargaining (Wong et al., 2025; Gouzoulis, 2024). Taken together, these results highlight how student debt can both constrain further investment in knowledge capital accumulation and limit real wage growth.

Second, knowledge capital exerts a positive effect on the labor share, although through different mechanisms over time. A 1% increase in knowledge capital raises the labor share by 0.62% after sixteen periods (Figure 1, panel (b)). In the short run, this effect operates through higher real wages associated with the greater accumulation of knowledge (Figure 4, panel (b)). In the medium run, however, the positive effect on the labor share arises from a decline in labor productivity, which appears counterintuitive (Figure 1, panel (d)). One possible interpretation is that indebted workers are willing to accept any job, including lower-quality positions, in order repay their debts, a behavior consistent with empirical evidence for the U.S. (Ji, 2021). Alternatively, the expansion of knowledge capital may not be matched by adequate labor market absorption, leading to job mismatch and a reduction in average labor productivity—a pattern consistent with the overeducation phenomenon discussed in Section 2.[9] Thus, the hypothesis that knowledge capital accumulation translates into a persistently higher labor share is not empirically confirmed in the medium run, possibly because it does not entail a sustained strengthening of workers' bargaining power in wage negotiations.

To examine the relationship between labor productivity, labor share, and real wages, we estimate a VAR model including these three variables. The results, reported in Appendix A, reveal a decoupling between labor productivity and real wages: a positive labor productivity shock reduces the labor share but does not lead to higher real wages. This finding suggests that the gains from higher labor productivity have been captured primarily by profits, indicating a distributive conflict between workers and capitalists over the social product. Moreover, our results align with the literature showing that the relationship between knowledge capital accumulation and labor productivity is not straightforward, nor are the subsequent effects of knowledge capital and labor productivity gains on wage income (Bowles and Gintis, 1975; Auerbach and Green, 2025).

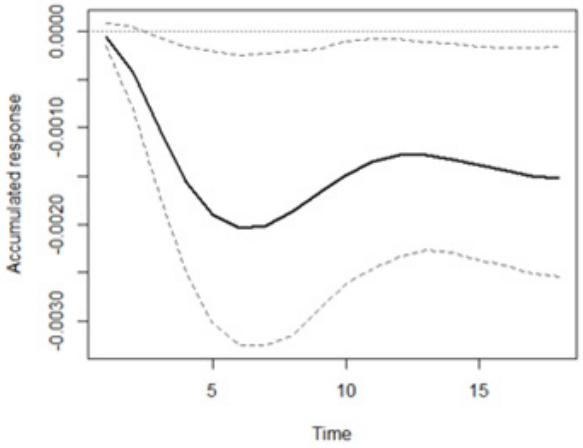
From this perspective, higher labor productivity may result, for example, from technological changes that reduce labor requirements in production. Consequently, the lower average labor cost reduces the wage share even without affecting the real wage. Moreover, comparing this finding with the previous result—that an increase in student debt negatively affects the labor share—suggests that the effect of knowledge capital accumulation on real wages does not operate through labor productivity. This finding supports the theoretical argument suggested by Lima et al. (2021), who note that the impact of knowledge capital on workers' bargaining power in wage negotiations may be due, inter alia, to an increase in workers' self-assurance and class--consciousness. Accordingly, from a classical political economy perspective, wage determination depends on institutions and power relations, rather than necessarily on labor productivity growth; indeed, it may not depend on labor productivity at all, at least not directly.

Third, we observe a negative effect of knowledge capital on workers' debt (Figure 2, panel (c)). A 1% increase in knowledge capital reduces student debt by 2.6% after sixteen quarters, representing a substantially large effect. One possible transmission channel operates through real wages and the labor share. As previously discussed, Barba and Pivetti (2009) and Constantini and Seccareccia (2020) argue that the decline in the labor share has contributed to an expansion of household debt. Conversely, higher labor income may reduce the need for household borrowing to sustain consumption and finance investment in knowledge capital. Additionally, as noted by Serra (2023) and Serra et al. (2025), rising labor income enhances workers' capacity to service debt, which in turn leads to lower debt levels.

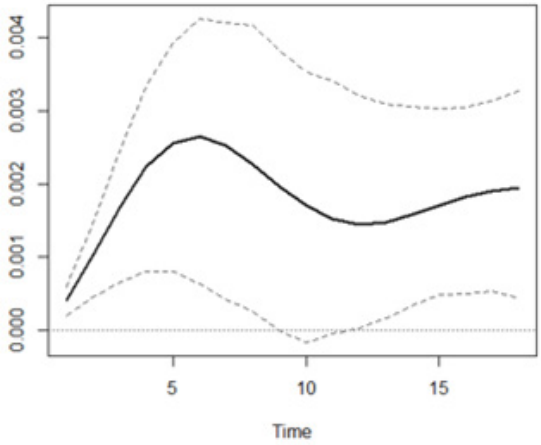
[9] As previously discussed, and as highlighted by Serra et al. (2025), student debt contributes to knowledge capital sustainably only if aggregate demand and the labor share are supported. In the absence of such support, rising student indebtedness may suppress the levels of output and employment, as well as the rate of output growth. As with any other form of productive capacity, knowledge capital does not automatically generate its own demand, making the implementation of expansionary demand policies essential alongside supply-side measures (Lima et al. 2021). Another possible explanation for this result is that greater knowledge capital accumulation may alter the social relations of production—in a Classical-Marxian sense—by reducing surplus extraction and the effort demanded from workers. However, this interpretation should be approached with caution, as we do not empirically test any proxy for workers' bargaining power in labor market negotiations, particularly with respect to wages.

Figure 1. Effects of student debt and knowledge capital shocks on the labor share and labor productivity

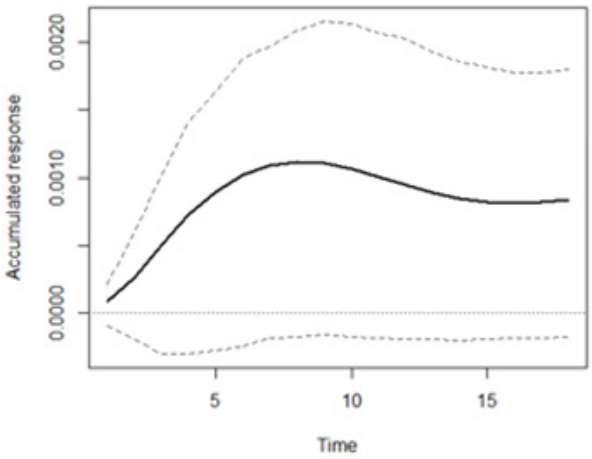
(a) Labor share response to a shock in student debt



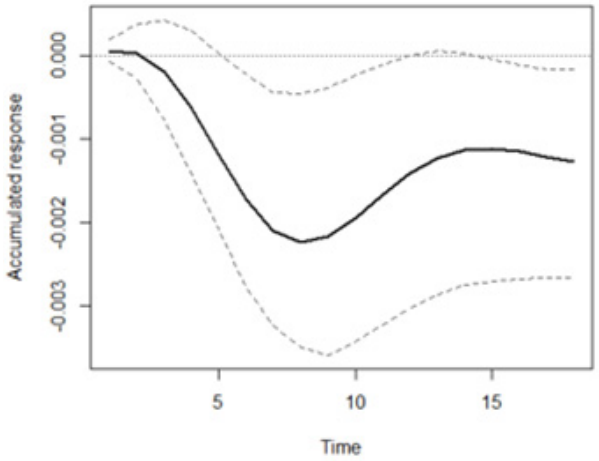
(b) Labor share response to a shock in knowledge capital



(c) Productivity response to a shock in student debt



(d) Productivity response to a shock in knowledge capital



Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

Fourth, we observe a positive effect of labor productivity on student debt (Figure 3, panel (a)). This finding can be interpreted as indicating that labor productivity gains, by compressing the labor share and hence potentially reducing self-financed investment in knowledge capital, may weaken working households' capacity to service debt and increase their reliance on borrowing to sustain desired levels of consumption and investment in knowledge capital.

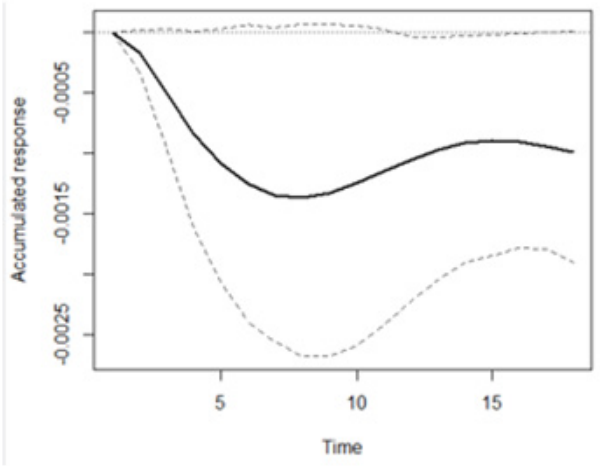
Fifth, we find that labor productivity has a negative effect on knowledge capital (Figure 3, panel (b)). This result suggests that workers may be unable to sustain their investments in knowledge capital over time, as labor productivity gains do not necessarily translate into higher income appropriation. In fact, this finding is consistent with the literature documenting a disconnection between real wages and labor productivity growth (e.g., Prettner, 2023; Elsby et al., 2013; Shaikh, 2016).

Several accumulated responses do not exhibit statistically significant effects. Specifically, knowledge capital does not respond to shocks in student debt or the labor share (Figure 2, panels (a) and (d)); student debt is unaffected by labor share shocks (Figure 2, panel (b)); labor productivity shows no response to student debt shocks (Figure 2, panel (c)); and knowledge capital does not react to real wage shocks (Figure 4, panel (d)). This pattern may indicate that these channels are either weak or mutually counterbalanced, that the considered effects require a longer horizon to materialize, or that data limitations impede their detection.

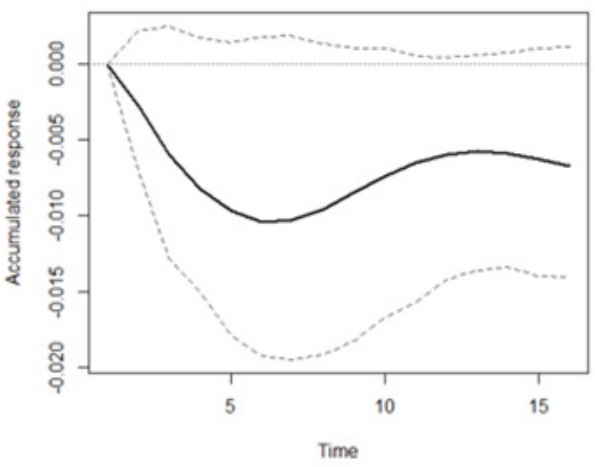
Finally, the accumulated response of student debt to a real wage shock exhibits a negative effect in the very short run (first quarter) (Figure 4, panel (c)). This finding suggests that when real wages increase, workers may immediately reduce their reliance on borrowing, likely by using higher current income to repay existing debt or to avoid taking on new debt. Over longer horizons, this effect does not persist, indicating that the short-run adjustment is temporary and may eventually be offset by other factors influencing student debt accumulation, such as ongoing education expenses or expectations of future income.

Figure 2: Interactions between student debt, knowledge capital, and the labor share

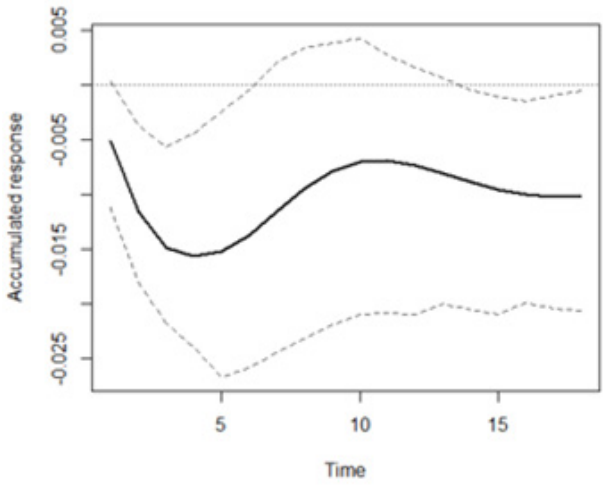
(a) Knowledge capital response to a shock in student debt



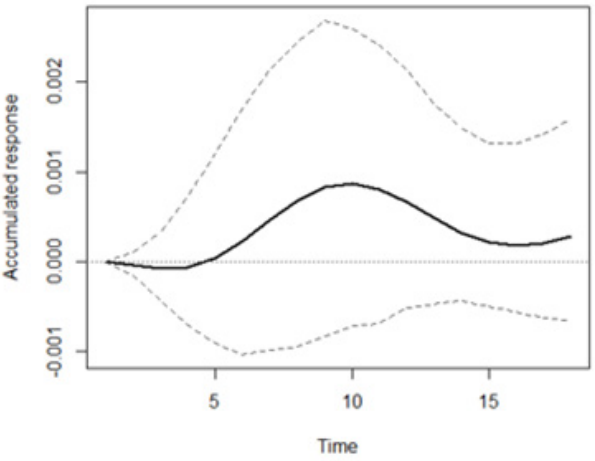
(b) Student debt response to a shock in labor share



(c) Student debt response to a shock in knowledge capital



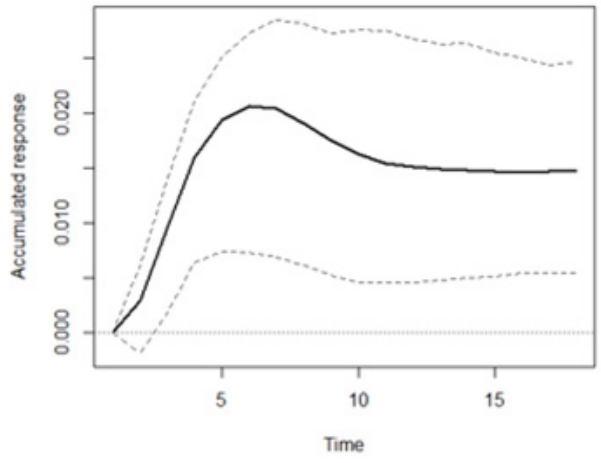
(d) Knowledge capital response to a shock in labor share



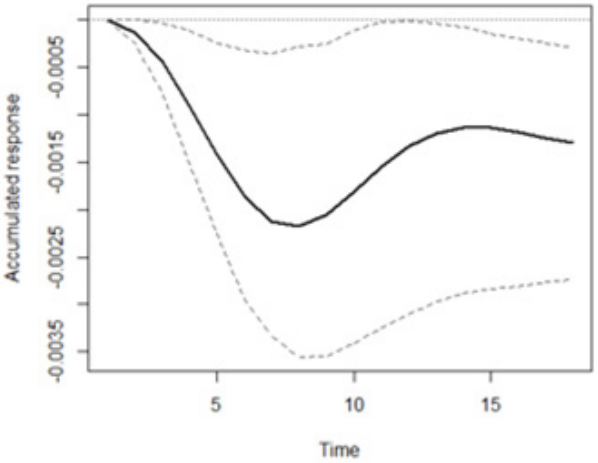
Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

Figure 3: Effects of labor productivity shocks on student debt and knowledge capital

(a) Student debt response to a shock in productivity



(b) Knowledge capital response to a shock in productivity

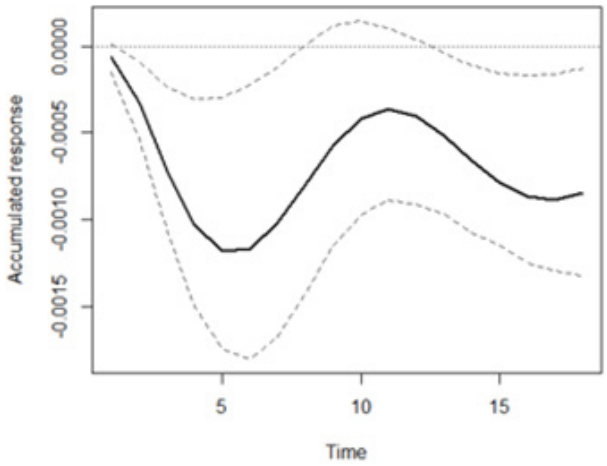


Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

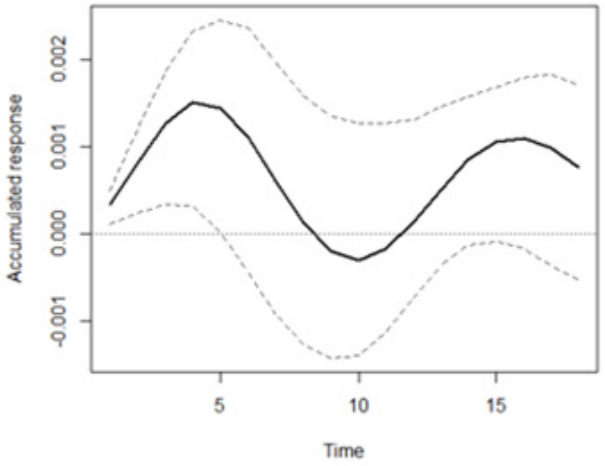
This evidence is consistent with the existing literature on the social determinants of educational attainment (Auerbach and Green, 2025; Cappelli et al., 2025). If investment in knowledge capital is at least partly autonomous from current economic conditions—as is typically assumed in Neo-Kaleckian modeling frameworks discussed in Section 3—rather than being determined by the availability of saving, and if access to credit alleviates liquidity constraints, then positive shocks to the labor share or real wages are not expected to necessarily increase knowledge capital accumulation. Rather, the primary effect of these positive shocks would be to reduce the share of investment financed through loans, thereby lowering student debt levels.

Figure 4: Effects of student debt and knowledge capital shocks on real wages

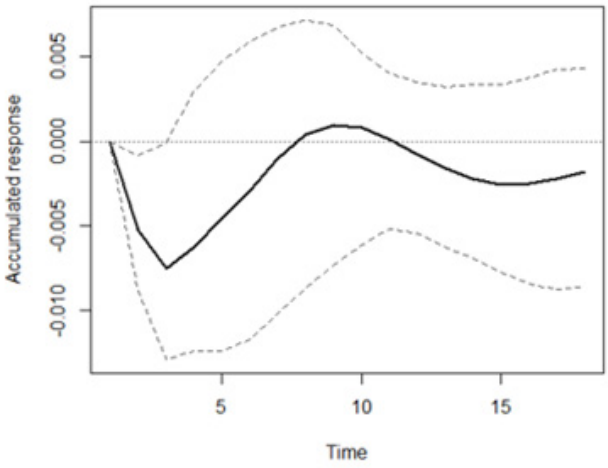
(a) Real wage response to a shock in student debt



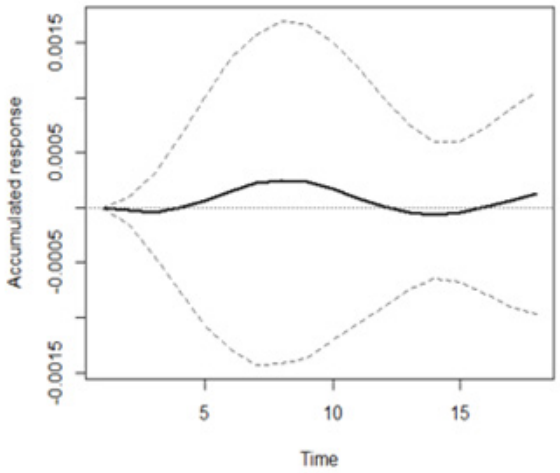
(b) Real wage response to a shock in knowledge capital



(c) Student debt response to a shock in real wages



(d) Knowledge capital response to a shock in real wages



Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

6. Political economy and policy implications

The empirical results presented in the preceding section point to several important political economy and policy implications. First, while student debt is associated with a negative effect on the labor share, the magnitude of this effect is relatively small; nevertheless, it may be economically meaningful given the substantial growth in the absolute level of student debt in recent decades. Accordingly, policy interventions should seek to limit excessive household student indebtedness while simultaneously promoting real wage growth. Potential policy measures include expanding access to publicly funded higher education to reduce dependence on student loans, as well as adopting labor-supportive policy measures such as strengthening collective bargaining institutions and increasing minimum wages.

Putting differently, even modest negative effects of student debt on the labor share can have significant macroeconomic consequences when debt levels are high. Limiting household student indebtedness is not only a matter of individual financial well-being but also a key factor in sustaining the labor share in social product and

broader economic stability. In this sense, public policies that reduce reliance on debt and strengthen workers' bargaining power in wage negotiations help ensure that labor productivity and output growth translate into real improvements in wages, employment conditions, and financial security for working households.

Second, the positive effect of knowledge capital on the labor share, together with its capacity to mitigate student debt, underscores the role of public education not only in fostering knowledge capital but also in shielding workers from financial vulnerability, thereby acting as a macroeconomic stabilizer. In this sense, knowledge capital continues to function as a "defensive" mechanism—or even a strategic resource weapon—for workers in the distributive conflict over social product, which further strengthens the case for public education and other related public policies aimed at enhancing workers' knowledge capital.

In other words, investing in knowledge capital actually does more than improve individual skills or labor productivity; it provides workers with a form of safe protection against economic shocks and rising debt burdens. It also enhances their bargaining position in the labor market, particularly in wage negotiations, allowing them to secure a fairer share of the social product. Put differently, public education and related public policies serve not only as a means of knowledge capital accumulation by workers but also as structural tools that stabilize the labor share in the social product and reduce income inequality, reinforcing the broader social and economic value of investing in knowledge capital through public funding.

Third, labor productivity gains alone do not guarantee either sustained investment in knowledge capital by workers or higher real wages, indicating that aggregate demand-side policies and stronger labor bargaining power are necessary to translate labor productivity improvements into larger wage and employment increases. In other words, labor productivity growth does not automatically benefit workers unless supported by institutional and macroeconomic conditions that strengthen labor's position in wage setting and ensure sufficient demand for labor. Without such conditions, labor productivity gains may be absorbed primarily through higher profits rather than broader employment expansion or wage growth.

Fourth, short-run increases in real wages may reduce student debt in the immediate period; however, without longer-run structural support—such as effective labor-market absorption of skills and affordable education—these effects are likely to be temporary. In other words, higher wages can ease debt burdens only as long as employment prospects remain favorably stable and workers are able to deploy their skills in adequately paid jobs. Absent sustained demand for skilled labor and institutional arrangements that keep education and other forms of knowledge capital accumulation affordable, workers may once again resort to borrowing to maintain consumption or invest in knowledge capital accumulation. As a result, temporary wage improvements, while beneficial, are insufficient to ensure lasting reductions in student debt. This underscores the need for coordinated public policies that combine education provision, wage support, and the stimulation of aggregate demand.

7. Robustness tests

7.1. Alternative proxy for knowledge capital

In Appendix B, we employ adults' years of schooling as an alternative proxy variable for knowledge capital. The results of the analysis using labor share are qualitatively similar to those reported previously, but they are more pronounced and exhibit greater statistical significance (Figure B1, panels (a) and (b)). The positive impact of knowledge capital on real wages persists, albeit with a higher temporal lag, now emerging around the seventh period (Figure B4, panel (b)). The positive effect of labor productivity on debt is also maintained, though it is considerably attenuated and observed only around the fourth period, indicating a substantially lower degree of persistence compared to the results reported previously (Figure B3, panel (a)). The previously observed negative effect of labor productivity on knowledge is no longer present (Figure B3, panel (b)). All other effects are qualitatively similar to those documented in Section 5.

Overall, all results remain qualitatively robust to the alternative specification, with the exception of the impulse responses shown in Figure B3, panel (b). This discrepancy likely reflects the fact that, when knowledge capital is measured by average years of schooling rather than by the share of individuals with a college degree, its relative importance in the dynamics under consideration is reduced.

7.2 Alternative ordering

We also estimate an alternative variable ordering in the VAR: student debt, knowledge capital, and labor share (labor productivity/real wages). Given that labor share and its components are the most endogenous variables—being jointly influenced by both knowledge accumulation and financial conditions—we retain them in the third position, altering only the order of the first two variables. The results remain qualitatively robust, as illustrated in the figures in Appendix C. In Figure C2, panel (c), the response of student debt to knowledge capital remains negative, although the effect is confined to the short run. Overall, these findings reinforce the qualitative robustness of the results.

8. Concluding remarks

This paper investigates the dynamic relationships involving knowledge capital accumulation (measured by the percentage of people who completed college), student indebtedness, and the distribution of the social product between labor income and non-labor income in the U.S. over the period 2003 to 2019—a period marked by a decline in the labor share, a widening gap between the growth rates of labor productivity and real wages, and a sharp increase in student debt. Drawing on a demand-led Neo-Kaleckian macroeconomic framework in the Cambridge, U.K. tradition, the study empirically tests theoretical propositions relating household student debt, workers' bargaining power and hence the labor share in the social product, and aggregate demand dynamics.

Using a Vector Autoregression (VAR) framework, we analyzed the interactions among knowledge capital, student debt, and the labor share in income, further decomposing the latter into its real wage and labor productivity components to identify the primary underlying transmission mechanisms. This approach allows for an assessment of how changes in financial and knowledge-related variables propagate through the functional distribution of income and macroeconomic dynamics, consistent with the theoretical insights of the Neo-Kaleckian framework.

The results indicate that an increase in student debt has a significant negative effect on the labor share, primarily through a reduction in real wages, while labor productivity remains largely unaffected. Although the estimated magnitude is modest, the effect becomes economically meaningful in light of the substantial expansion of student debt over the period under study. This finding is consistent with both theoretical and empirical evidence suggesting that indebtedness weakens workers' bargaining power in wage negotiations and constrains real wage growth, as debt-servicing obligations reduce workers' capacity or predisposition to demand higher wages. In fact, because having a job effectively serves as collateral for household borrowing (or rolling over outstanding debt), the obligation to service debt functions as an additional mechanism of worker discipline, alongside the disciplining effect of unemployment.

Conversely, knowledge capital exerts a positive effect on the labor share, albeit through different channels over time. In the short run, the effect operates through higher real wages associated with knowledge accumulation, whereas in the medium run it is associated with a decline in labor productivity—potentially reflecting job mismatch or the employment of overqualified or overeducated labor. Another possible explanation is that the accumulation of knowledge capital may not necessarily enhance workers' bargaining power in wage negotiations in a sustained manner. Moreover, knowledge capital significantly reduces student debt, while labor productivity shocks increase it, suggesting that higher labor income resulting from knowledge capital accumulation alleviates financial dependence on borrowing, whereas labor productivity gains that do not translate into wage increases can exacerbate indebtedness.

The analysis further highlights a decoupling between labor productivity and real wages: positive labor productivity shocks reduce the labor share without generating corresponding increases in real wages, indicating that labor productivity gains have been largely appropriated by profits. From a classical political economy perspective, this underscores that wage determination depends primarily on institutional and distributive factors rather than on labor productivity growth alone.

Taken together, these findings carry important political economy and public policy implications. Public policies should aim to limit excessive household student indebtedness while promoting real wage growth and strengthening collective bargaining. Expanding access to publicly funded higher education can reduce reliance on student loans, while labor-friendly and aggregate demand-oriented macroeconomic policies can help ensure that labor productivity gains are reflected in higher real wages and employment. Ultimately, public investment in education and pro-worker labor market institutions not only enhances knowledge capital accumulation but also functions as a macroeconomic stabilizer, supporting both financial resilience and a more equitable distribution of the social product between labor and non-labor income.

References

Abel, J. R., and Deitz, R. 2014. Do the benefits of college still outweigh the costs? *Current Issues in Economics and Finance*, vol. 20, no. 3.

Abel, J. R., Deitz, R., and Su, Y. 2014. Are recent college graduates finding good jobs? *Current Issues in Economics and Finance*, vol. 20, no. 1.

Amsden, A. H. 2010. Say's law, poverty persistence, and employment neglect. *Journal of Human Development and Capabilities*, vol. 11, no. 1, 57–66.

Ashworth, J., and Ransom, T. 2019. Has the college wage premium continued to rise? Evidence from multiple US surveys. *Economics of Education Review*, vol. 69,149–154.

Athreya, K., and Eberly, J. 2021. Risk, the college premium, and aggregate human capital investment. *American Economic Journal: Macroeconomics*, vol. 13, no. 2, 168–213.

Barba, A., and Pivetti, M. 2009. Rising household debt: Its causes and macroeconomic implications - a long--period analysis. *Cambridge Journal of Economics*, vol. 33, no. 1,113–137.

Becker, G. S. 1964. *Human capital: a theoretical and empirical analysis, with special reference to education*. New York: Columbia University Press.

Black, S. E., Denning, J. T., Dettling, L. J., Goodman, S., and Turner, L. J. 2023. Taking it to the limit: Effects of increased student loan availability on attainment, earnings, and financial well-being. *American Economic Review*, vol .113, no. 12, 3357–3400.

Carvalho, L. B., Lima, G. T., Serra, G. P. 2024. Household debt, knowledge capital accumulation, and macroeconomic performance. *Journal of Post Keynesian Economics*, vol. 47, 84–116.

Cauvel, M. and Pacitti, A. 2022. Bargaining power, structural change, and the falling U.S. labor share. *Structural Change and Economic Dynamics*, vol. 60, 512–530.

Costantini, O., and Seccareccia, M. 2020. Income distribution, household debt and growth in modern financialized economies. *Journal of Economic Issues*, vol. 54, no .2, 444–453.

Davia, M. A., McGuinness, S., and O'Connell, P. J. 2017. Determinants of regional differences in rates of overeducation in Europe. *Social Science Research*, vol. 63, 67–80.

Dutt, A. K. 2006. Maturity, stagnation and consumer debt: A Steindlian approach, *Metroeconomica*, vol. 57, no. 3, 339–64.

Elsby, M., Hobijn, B., Sahin, A. 2013. The decline of the U.S. labor share. Federal Reserve Bank of San Francisco. Working Paper Series.

Federal Research Bank of New York (FRBNY). 2025. Quarterly Report on Household Debt and Credit—2025: Q3. Released in November 2025.

Friedman, M. 1955. *The role of government in education*. In Solo, R. A. (Ed.), In Economics and the Public Interest, 123–144. New Brunswick, New Jersey: Rutgers University Press.

Fu, C., Lin, H. C. L., and Tanaka, A. 2025. *College Loans and Human Capital Investment* (No. w34221). National Bureau of Economic Research.

Gouzoulis, G. 2024. Does household indebtedness contribute to the decline of union density? *New Political Economy*, vol. 29, no. 3, 414–431.

Guschanski, A. and Onaran, Ö. 2021. The decline in the wage share: falling bargaining power of labour or technological progress? Industry-level evidence from the OECD. *Socio-Economic Review*, vol. 20, no. 3, 1091–1124.

Ji, Y. 2021. Job Search under Debt: Aggregate Implications of Student Loans. *Journal of Monetary Economics*, vol. 117, 741–759.

Kim, Y., Lima, G. T., and Setterfield, M. 2019. Political aspects of household finance: debt, wage bargaining, and macroeconomic (in)stability. *Journal of Post Keynesian Economics,* vol. 42, no. 1, 16–38.

Lima, G. T., Carvalho, L. B., and Serra, G. P. 2021. Human capital accumulation, income distribution, and economic growth: a demand-led analytical framework. *Review of Keynesian Economics*, vol. 9, no. 3, 319–336.

Lochner, L. J., Monge-Naranjo, A. 2011. The Nature of Credit Constraints and Human Capital. *American Economic Review*, vol. 101, no. 6, 2487–2529.

Lütkepohl, H. 2005. *New Introduction to Multiple Time Series Analysis*. Springer, 2005.

Marquetti, A., Morrone, H., and Miebach, A. 2021. 'The Extended Penn World Tables 7.0'. Texto para Discussão 2021/01, Universidade Federal do Rio Grande do Sul.

Mincer, J. 1958. Investment in human capital and personal income distribution. J*ournal of Political Economy*, vol. 66, no. 4, 281–302.

Oreopoulos, P., Von Wachter, T., and Heisz, A. 2012. The short-and long-term career effects of graduating in a recession. *American Economic Journal: Applied Economics*, vol. 4, no. 1, 1–29.

Palley, T. I. 2010. Inside debt and economic growth: a neo-Kaleckian analysis. In: Setterfield, M. (Ed.). *Handbook of Alternative Theories of Economic Growth*, Edward Elgar.

Pinto, S.; Steinbaum, M. 2021. *Hysteresis & Student Debt*. Phenomenal World, June 10. https://www.phenomenalworld.org/analysis/hysteresis-student-debt/

Prettner, K. 2023. Stagnant wages in the face of rising labor productivity: the potential role of industrial robots. *Finance Research Letters*, vol. 58, part D, 104687.

Rowthorn, R. E. 1977. Conflict, inflation and money. *Cambridge Journal of Economics*, vol. 1, no. 3, 215–239.

Serra, G. P., Sanches, M. S., Lima, G. T. 2025. 'Workers trying to climb the income ladder: debt-financed knowledge capital accumulation and distributive conflict'. *Working Paper* n. 31. Research Center on Macroeconomics of Inequalities - Made, University of São Paulo.

Serra, G. P. 2023. Household debt, student loan forgiveness, and human capital investment: a neo-Kaleckian approach. *Journal of Post Keynesian Economics*, vol. 46, no. 1, 173–206.

Serra, G. P. 2025. (Trying to) catch up with the higher-skilled Joneses: student loans in a segmented educational market from a post-Keynesian perspective. *Journal of Post Keynesian Economics*, vol. 48, no. 2, 172–203.

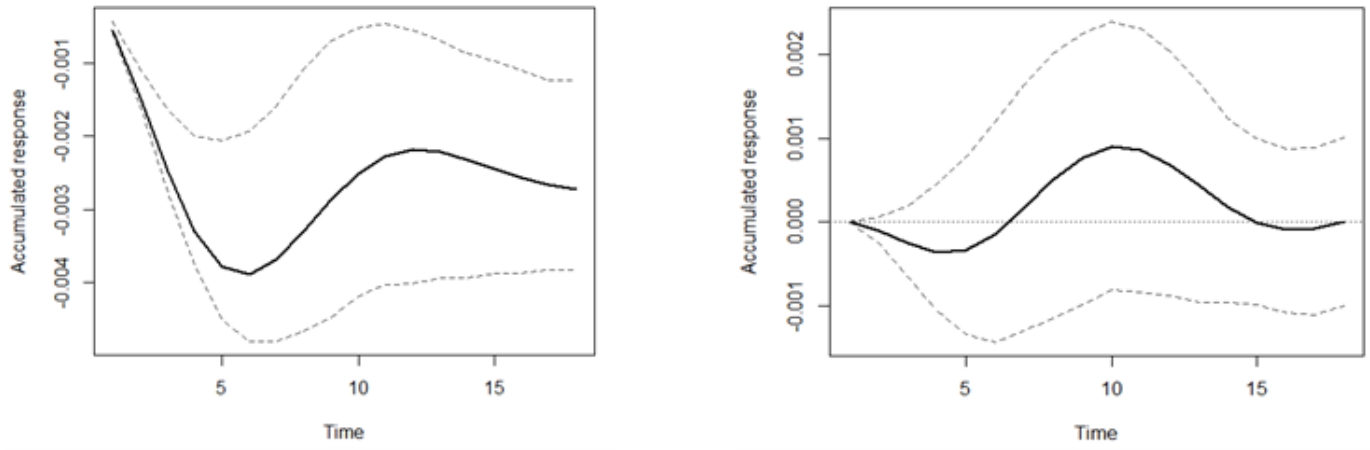
Shaikh, A. 2016. *Capitalism: Competition, conflict, crises*. Oxford University Press.

Wong, P., Gouzoulis, G., Galanis, G. 2025. 'Personal debt burden and union jobs: evidence from the United States'. Working Paper SSRN.

APPENDIX A - Additional exercise

To examine the dynamic relationships involving the labor share, labor productivity, and real wages, we estimate a VAR model with the following ordering: real wages, labor productivity, and labor share, with the latter treated as the most endogenous variable, as it is determined by the first two. Two lags are included based on standard lag-selection criteria, although estimations with three and four lags produce similar results. We also consider an alternative ordering in which labor productivity precedes real wages, and the results remain robust. The VAR model satisfies the stability condition and shows no evidence of residual autocorrelation. Although some heteroskedasticity is detected in one of the estimated equations, confidence intervals are constructed using bootstrap methods. The results indicate that labor productivity has a statistically significant negative effect on the labor share, while it does not affect real wages (Figure A1).

Figure A1: Accumulated response of the labor share (left panel) and real wages (right panel) to a shock in labor productivity

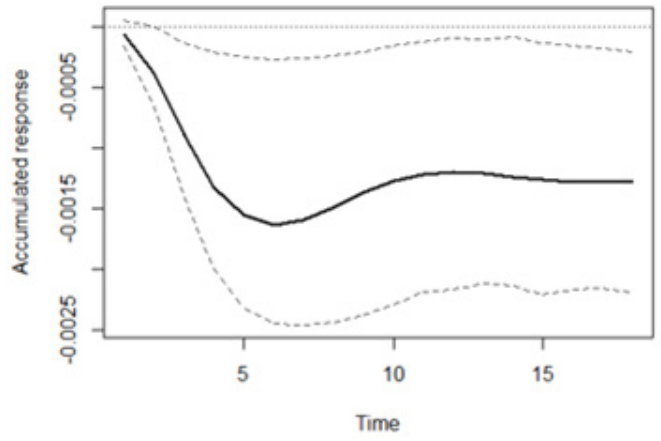


Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

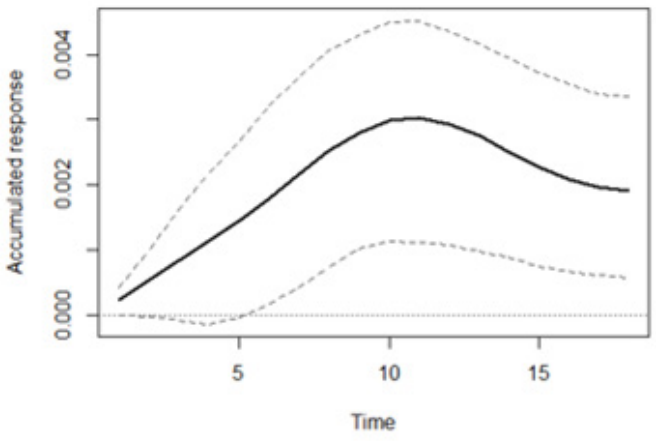
APPENDIX B

Figure B1: Effects of student debt and knowledge capital shocks on the labor share and labor productivity: alternative proxy variable for knowledge capital

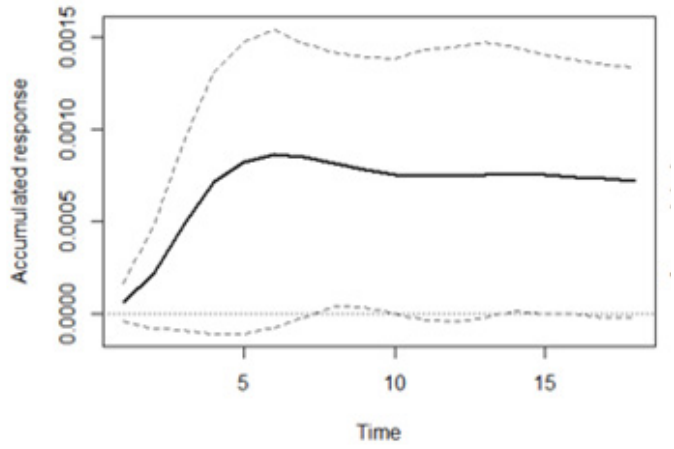
(a) Labor share response to a shock in student debt



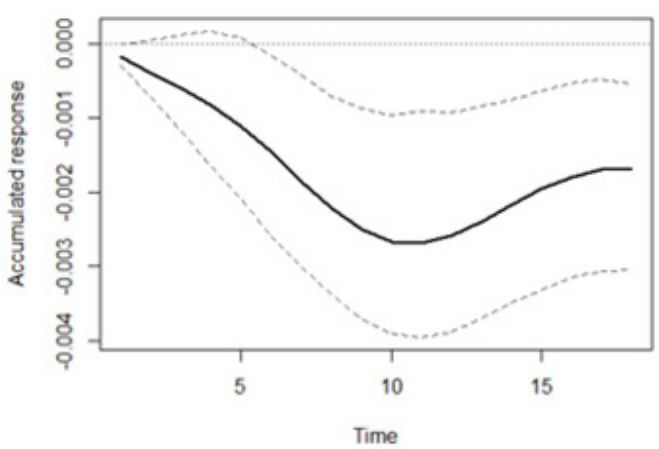
(b) Labor share response to a shock in knowledge capital



(c) Productivity response to a shock in student debt



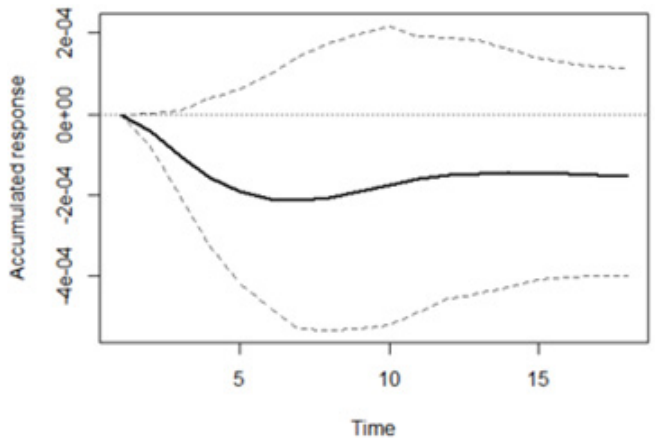
(d) Productivity response to a shock in knowledge capital



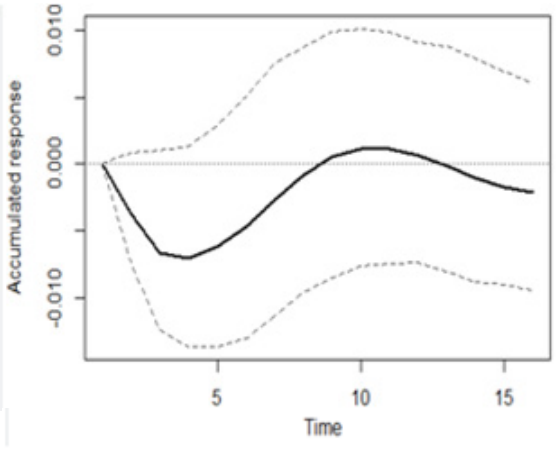
Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

Figure B2: Interactions between student debt, knowledge capital, and the labor share: alternative proxy variable for knowledge capital

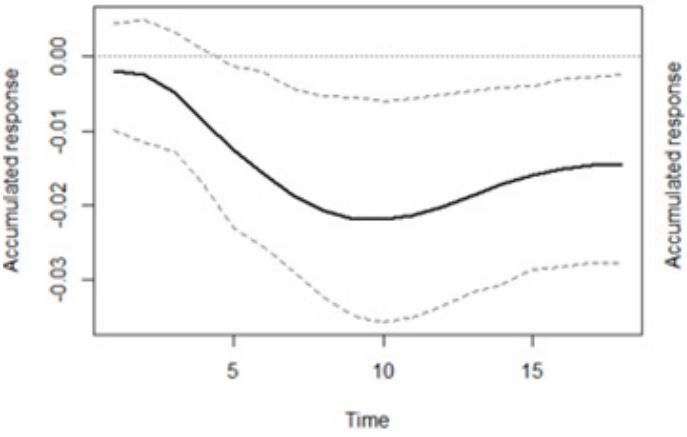
(a) Knowledge capital response to a shock in student debt



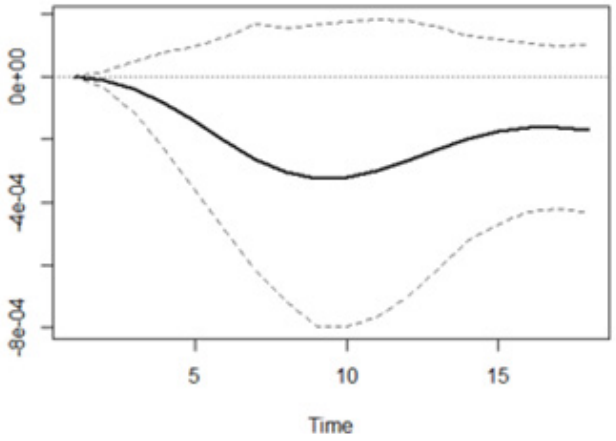
(b) Student debt response to a shock in labor share



(c) Student debt response to a shock in knowledge capital



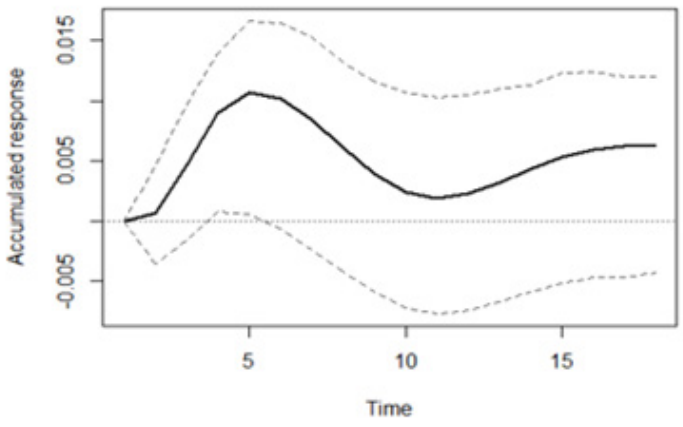
(d) Knowledge capital response to a shock in labor share



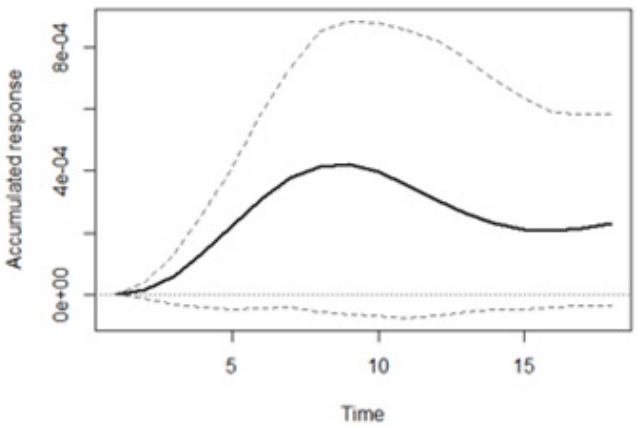
Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

Figure B3: Effects of labor productivity shocks on student debt and knowledge capital: alternative proxy variable for knowledge capital

(a) Student debt response to a shock in productivity



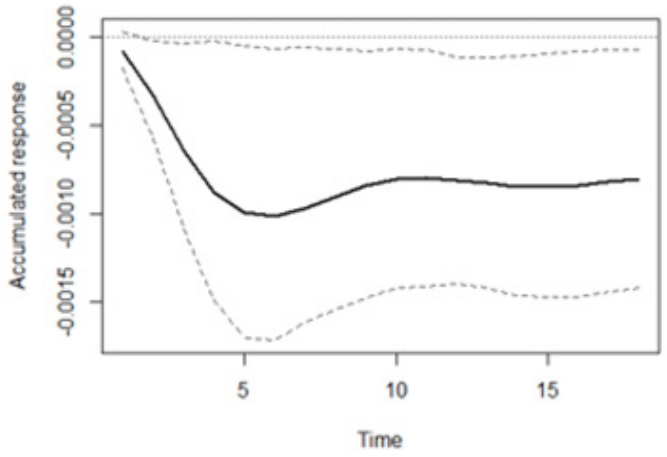
(b) Knowledge capital response to a shock in productivity



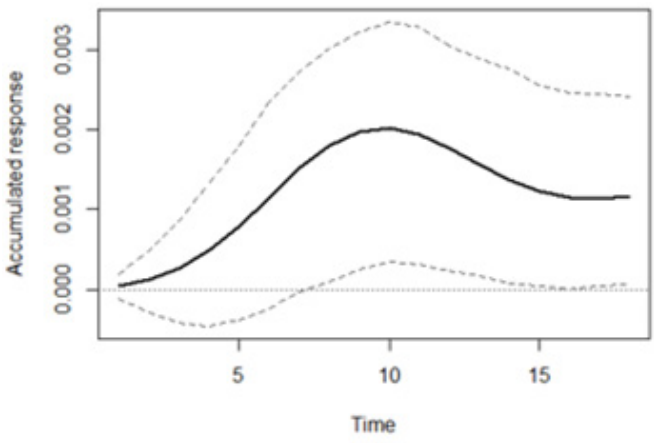
Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

Figure B4: Effects of student debt and knowledge capital shocks on real wages: alternative proxy variable for knowledge capital

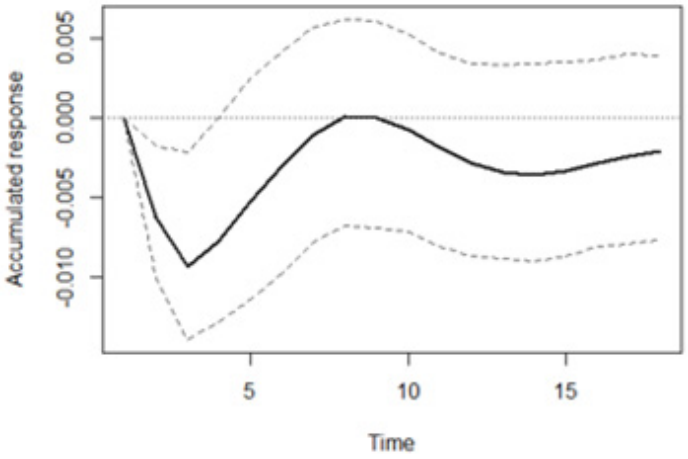
(a) Real wage response to a shock in student debt



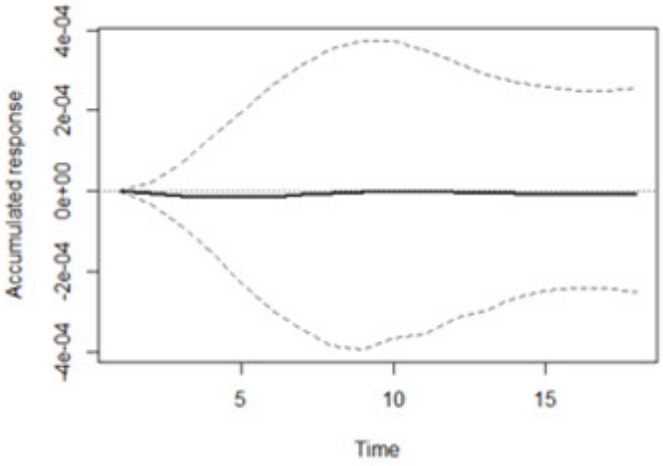
(b) Real wage response to a shock in knowledge capital



(c) Student debt response to a shock in real wages



(d) Knowledge capital response to a shock in real wages

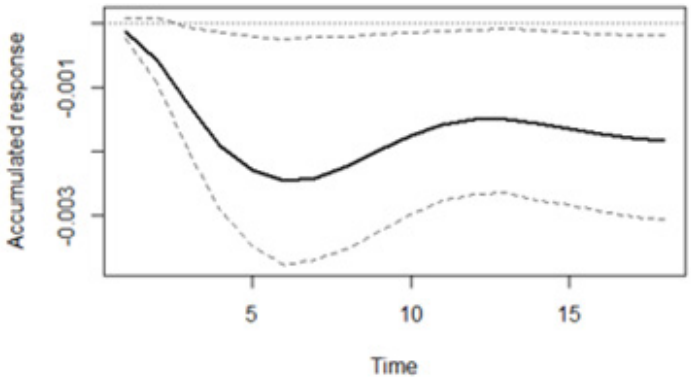


Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

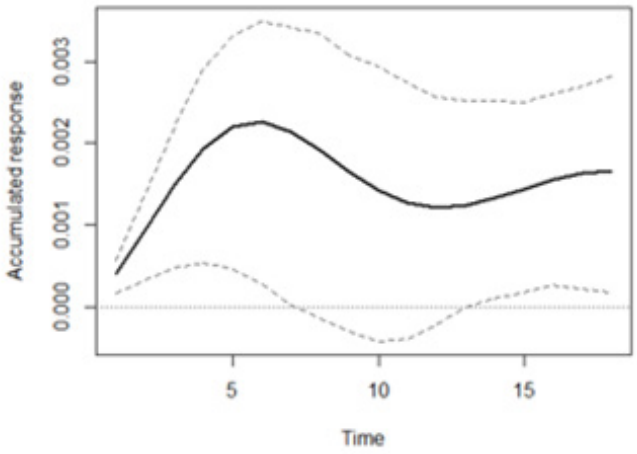
APPENDIX C

Figure C1: Effects of student debt and knowledge capital shocks on the labor share and labor productivity: alternative ordering

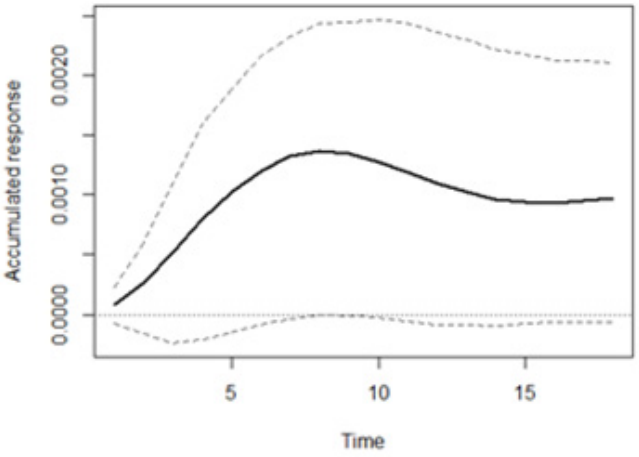
(a) Labor share response to a shock in student debt



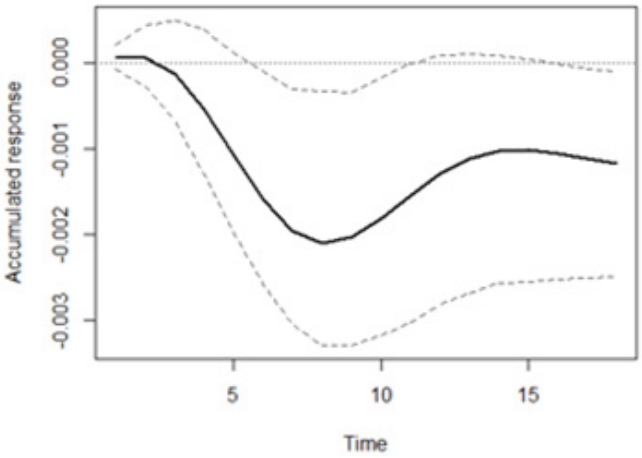
(b) Labor share response to a shock in knowledge capital



(c) Productivity response to a shock in student debt



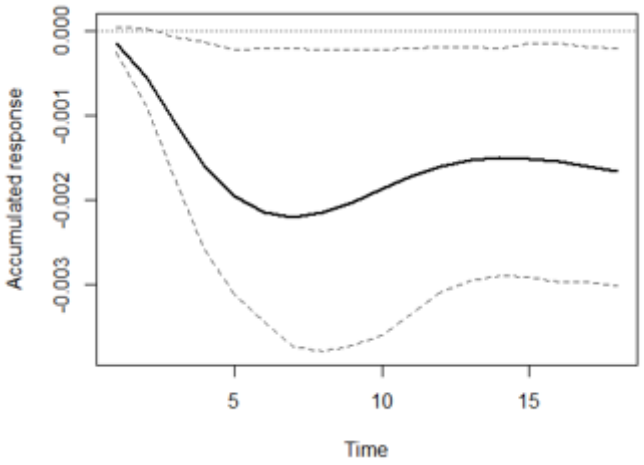
(d) Productivity response to a shock in knowledge capital



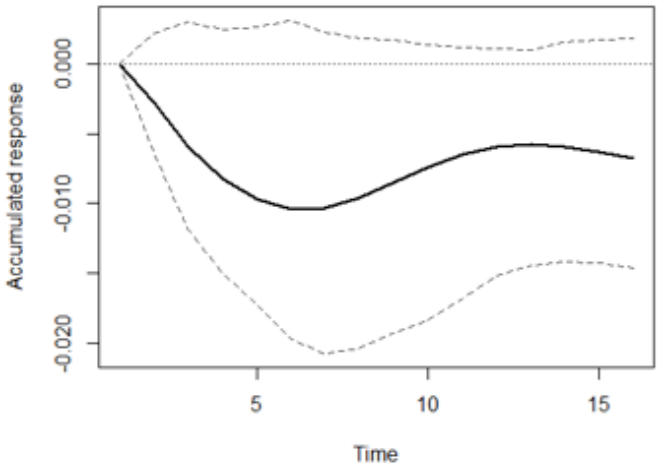
Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

Figure C2: Interactions between student debt, knowledge capital, and the labor share: alternative ordering

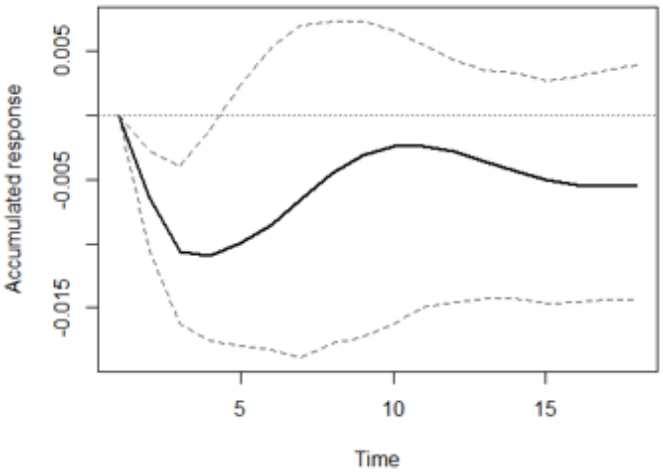
(a) Knowledge capital response to a shock in student debt



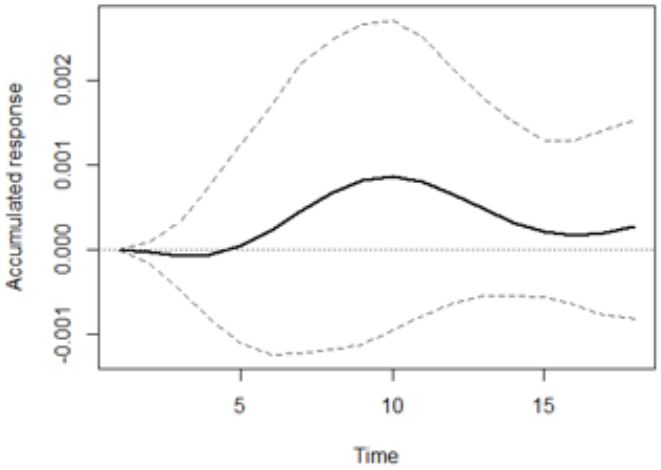
(b) Student debt response to a shock in labor share



(c) Student debt response to a shock in knowledge capital



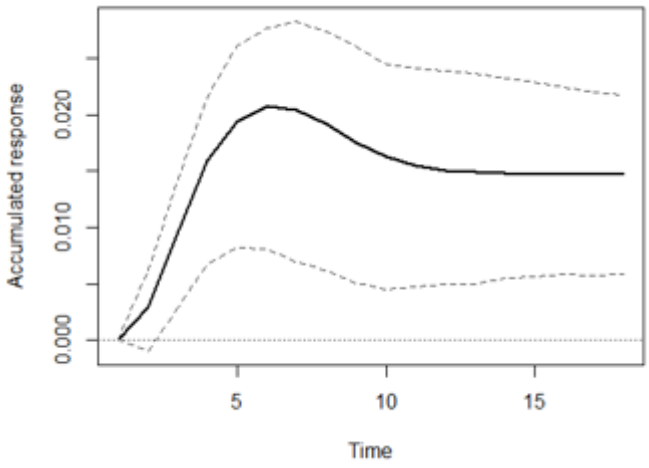
(d) Knowledge capital response to a shock in labor share



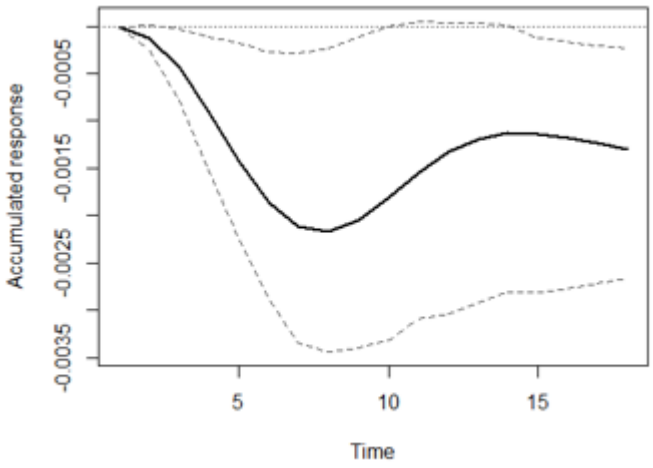
Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

Figure C3: Effects of labor productivity shocks on student debt and knowledge capital: alternative ordering

(a) Student debt response to a shock in productivity



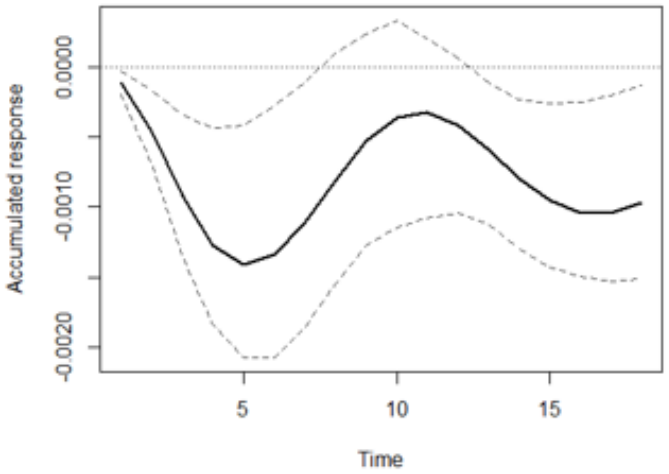
(b) Knowledge capital response to a shock in productivity



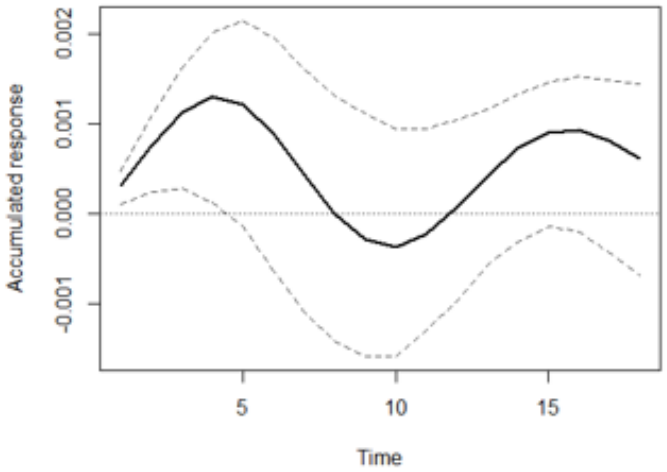
Dashed lines represent 90% confidence intervals. Source: authors' elaboration.

Figure C4: Effects of student debt and knowledge capital shocks on real wages: alternative ordering

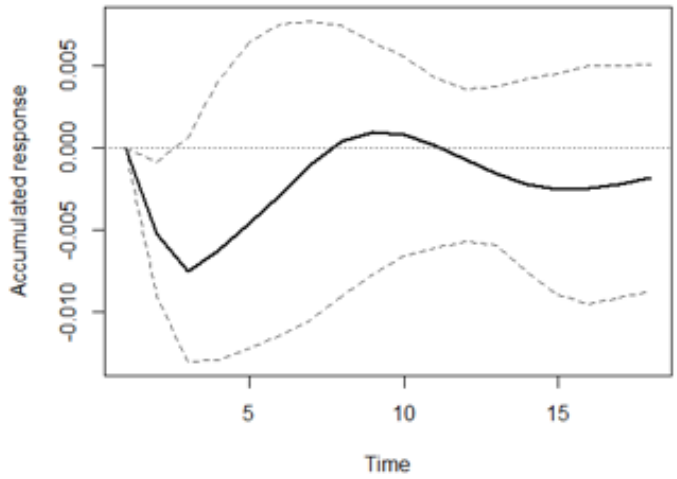
(a) Real wage response to a shock in student debt



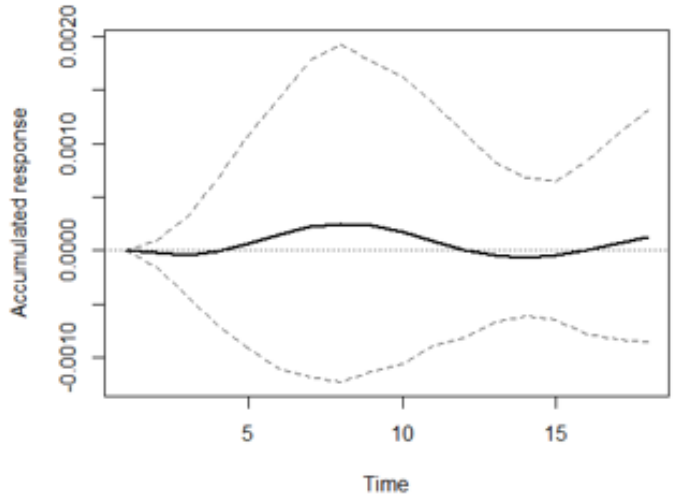
(b) Real wage response to a shock in knowledge capital



(c) Student debt response to a shock in real wages



(d) Knowledge capital response to a shock in real wages



Dashed lines represent 90% confidence intervals. Source: authors' elaboration.