Structural Changes in Investment and the Waning Power of Monetary Policy

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Abstract

We argue that secular change in both the production and composition of investment goods has weakened investment's role in the transmission of monetary policy to labor earnings and consumption. We show analytically that fluctuations in the production of investment goods amplify the response of consumption to monetary policy shocks by varying labor income for hand-to-mouth agents. We document three secular changes weakening this channel: (i) labor's share of value added in investment goods production has declined, (ii) the import share of investment goods has risen, and (iii) the composition of investment has shifted towards components that are less responsive to monetary policy. A small open economy, two agent New Keynesian model calibrated to match these facts implies a 23 percent weaker response of labor income and a 17 percent weaker response of consumption to real interest rate shocks in a 2020s economy relative to a 1960s economy.

To view the authors' disclosure statements, visit
https://www.newyorkfed.org/research/staff_reports/sr1190.html.

1 Introduction

Growing evidence suggests that monetary policy shocks have smaller effects on economic activity now than in the past, even putting aside issues of an effective lower bound on interest rates. Multiple authors, using various empirical techniques, report declining responsiveness of real output and inflation (Boivin, Kiley and Mishkin, 2010), consumer durables (Van Zandweghe and Braxton, 2013), employment (Willis and Cao, 2015), and investment (Baldi and Lange, 2019) to U.S. monetary policy shocks.[1]

This paper proposes a partial explanation: secular change in both the production and composition of investment goods has weakened private investment's role in the transmission of monetary policy to labor earnings and consumption. The importance of investment in driving consumption fluctuations in heterogeneous agent models where some households have high marginal propensities to consume (MPC's) out of labor income has recently been demonstrated quantitatively by Auclert, Rognlie and Straub (2022) and analytically by Bilbiie, Känzig and Surico (2022). In such models, investment amplifies fluctuations in consumption by generating labor income for high-MPC households. The high volatility of investment in U.S. data means that investment fluctuations play an outsized role in driving consumption fluctuations in such calibrated models.

We revisit this mechanism in a parsimonious, two-agent framework that links the consumption of hand-to-mouth agents to investment. We depart from the analyses of the previous authors by studying an open economy environment, revealing an important role for imports. We show that the response of consumption by hand-to-mouth agents to changes in the real interest rate depends on both (i) the responsiveness of investment and (ii) the extent to which investment generates labor income domestically. We label this second term the *domestic labor content*, which we measure from publicly available data. We then show how secular changes have lead to declines in the domestic labor content particularly for equipment and durable goods, while at the same time the composition of investment has shifted away from components of investment that are responsive to monetary policy shocks (equipment, durable goods, and structures) and towards components that are less sensitive to monetary

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[1]See also Boivin et al. (2010) for a summary of an older literature on the declining interest rate sensitivity of the U.S. economy.

policy shocks (intellectual property products, such as R&D and software). Viewed through the lens of our calibrated model, these shifts imply large declines for the transmission of changes in real interest rates to labor income and consumption.

We begin by reviewing changes in the composition of investment and consumer durables since 1947. The most notable change is the rise in "Intellectual Property Products" (IPP) which has grown from less than 1% of GDP around 1950 to over 5.5% of GDP by the beginning of 2024, now accounting for more than a fifth of nominal spending on investment and durables. At the same time, investment in tangible goods such as equipment, durable goods, and structures, fell as a share of GDP. Estimating empirical impulse response functions for each component of investment and durables, we find that IPP is an order of magnitude less responsive to monetary policy shocks than the other components of investment, consistent with firm-level evidence that suggests "intangible" investment spending is relatively insensitive to monetary policy (Caggese and Pérez-Orive, 2022; Döttling and Ratnovski, 2023) and behaves more like a fixed cost (De Ridder, 2023).

Next, we measure the domestic labor content of investment spending and its subcomponents using publicly available Input-Output (I-O) tables. The domestic labor content of investment and durable goods has fallen from 58 cents on the dollar to 46 cents on the dollar from 1963-2023. This is driven primarily by an increase in the share of import content of equipment and durable goods, and to a lesser extent a declining labor share of domestic value added in equipment, durable goods, and structures.

To study the effects of these observed trends in a general equilibrium setting, we develop a two-agent, five-sector, small open economy New Keynesian model. Households are split between intertemporally optimizing "Ricardian" agents and hand-to-mouth agents. Production is partitioned between three domestic investment good sectors, a domestic consumption good sector, and a traded export good sector. The investment good sectors' outputs are themselves bundled by a capital services firm and rented out as a single capital input. We show analytically that the amplification of monetary policy shocks to aggregate consumption depends on the product of four objects: the share of hand-to-mouth agents, investment components' domestic labor content, investment components' share of aggregate expenditure relative to consumption, and the responsiveness of investment to shocks.

To derive our headline results, we calibrate the model separately to reflect a "1960s" U.S. economy and a "2020s" U.S. economy, matching observed changes in the domestic labor content of all final demand components and the composition of gross investment. We then compute the cumulative 12-quarter response of labor income, consumption, and investment to the same real interest rate shock under each calibration. This experiment suggests a 23% weaker response of labor income and a 17% weaker response of consumption, alongside a 15% weaker response of investment to real interest rate shocks in a 2020's economy relative to a 1960's economy. While the decline in the responsiveness of real investment spending to monetary policy shocks is almost entirely due to tilting the composition of final capital services towards IPP, the declining responsiveness of consumption and labor income are driven by both the composition changes of investment and the decline in the domestic labor content of investment goods.

Lastly, we find that an increased trade share of the U.S. economy and the possibility of a stronger exports channel of monetary policy does not offset our findings. Indeed, the model predicts that in response to an expansionary monetary policy shock, net exports *declines* in the short run—funded by net borrowing vis a vis the rest of the world—and later turns positive. This is because rising demand for imports immediately following the shock—driven by an increase in import-intensive investment—more than offsets an increase in exports from a weaker exchange rate. While this conflicts with standard textbook narratives regarding the effects of expansionary monetary policy in an open economy (e.g., Krugman, Melitz and Obstfeld, 2015), this response of net exports has empirical support in recent work (e.g., Degasperi, Hong and Ricco, 2024; Cloyne, Ferreira and Surico, 2020; Kim, 2001).

The remainder of the paper is organized as follows. Section 2 reviews the changing composition of investment, estimates empirical impulse responses of the components of investment to monetary policy shocks, and documents secular changes in the domestic labor content of the components of investment. Section 3 presents a two agent, small open economy New Keynesian model with five sectors—consumption, export goods, and three different kinds of investment goods—and conducts monetary policy experiments to illustrate how observed changes in the domestic labor content of investment mute the effects of monetary policy on consumption in general equilibrium. Section 4 concludes.

1.1 Related Literature

This paper is related to recent work using firm-level data to study the response of intangible investment to monetary policy. Döttling and Ratnovski (2023) show that the stock prices of firms with a greater share of intangible capital respond less to monetary policy shocks, citing less of an ability to fund intangible assets with collateral, thereby weakening the credit channel, as well as intangible capital's higher depreciation rate than tangible capital. Caggese and Pérez-Orive (2022) show that firms with more intangible assets depend substantially more on internal savings than collateralized financing, dampening the response of investment to the collateral channel of monetary policy, which Cloyne, Ferreira, Froemel and Surico (2023) identify as a quantitatively significant channel through which monetary policy affects investment by publicly traded firms in the U.S. Consistent with this, other authors have highlighted that cash-flow based financing (Lian and Ma, 2021) and equity financing are more important for intangible investment than other kinds of investment (e.g., Bianchi et al., 2019; Dogan and Ozturk, 2024), potentially explaining its reduced interest rate sensitivity relative to other kinds of investment which may be financed with asset-based borrowing. Howes and White (2026) find that loosening financial constraints in the later half of the 20th century in the U.S. decreased the volatility of aggregate employment, particularly in the manufacturing sector. Our parsimonious general equilibrium model abstracts from these changes in the financing of aggregate investment, focusing instead on the decline in the domestic labor content and capturing the reduced interest-rate sensitivity of investment simply through higher adjustment costs; see Bloesch and Weber (2025) for a thorough discussion of investment adjustment costs and intangible investment.[2]

A large body of related work uses I-O tables to study the changing production structure of investment goods. Herrendorf, Rogerson and Valentinyi (2020) show that investment is increasingly produced in the service sector, and Hubmer (2023) studies changes in the labor content of production for various categories of U.S. final demand going back to 1982 as part of his exploration of the decline in the aggregate U.S. labor share, including investment. The growth implications of the increasing importance of imports in satisfying domestic invest-

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[2]Modeling intangible investment as subject to higher adjustment costs is a common approach: see, e.g., Moran and Queralto (2018), Bianchi et al. (2019), and Cloyne et al. (2022).

ment demand has been studied by Cavallo and Landry (2018, 2010) while House, Mocanu and Shapiro (2022) provide evidence that positive shocks to the demand for investment goods result in substantially higher imports. We depart from these studies by bringing in additional data to extend our analysis with I-O tables back to the 1960s and by focusing on the implications for the transmission of monetary policy. For a related study which uses I-O tables to to study the implications for optimal fiscal policy in the presence of households with heterogeneous marginal propensities to consume, see Flynn, Patterson and Sturm (2024).

Finally, this paper relates to a growing body of work on the importance of indirect effects (e.g., Alves, Violante, Kaplan and Moll, 2020; Kaplan, Moll and Violante, 2018) and crucial role of investment spending specifically (e.g., Luetticke, 2021; Ottonello and Winberry, 2020) in the transmission of monetary policy in heterogeneous-agent New Keynesian models. We diverge from this literature in our focus on documenting secular change in the transmission of monetary policy, which leads us to abstract from many of the model features that prove important for determining the level of the consumption and investment responses to monetary policy, such as the distribution of profits and incidence of changes in aggregate labor income across different types of agents, financial frictions, etc. Relative to recent work using open-economy TANK models to study the implications of trade fragmentation (Ambrosino, Chan and Tenreyro, 2026) and the composition of consumption (Boehnert, De Ferra, Mitman and Romei, 2025) for the transmission of monetary policy, we introduce capital and focus on the implications of secular change in the production of investment for the transmission of monetary policy to consumption and labor income.

2   Motivation and Empirical Findings

In this section, we first present the motivating facts that real consumption and real labor income's interest rate sensitivity appears to have declined in the United States. We then document two key facts that contribute to this apparent secular change: a shift in the composition of investment spending towards categories that are insensitive to monetary policy, and a decrease in the domestic labor content of the more sensitive investment categories. Specifically, Section 2.2 breaks investment demand into its components to show that an in-

creasing share of investment spending is classified as "intellectual property products" (IPP), which are quite unresponsive to monetary policy. Section 2.3 documents that the domestic labor content of investment goods has declined, due to both a rising import share and falling labor share of value added, and that these changes are concentrated in the production of equipment and durable goods, which are relatively sensitive to monetary policy shocks.

As discussed in the introduction, the reason that declining interest rate sensitivity and domestic labor content of investment implies declining labor income *and consumption* sensitivity to investment may at first seem non-obvious. In standard representative agent New Keynesian frameworks, the path of real interest rates perfectly pins down the path of real consumption through the representative household's Euler equation, leaving no role for the production structure of the economy (such as the composition and labor content of investment) to affect the relationship between real rates and consumption.[3] In contrast, Auclert et al. (2022) show that in models with heterogeneous agents with high marginal propensities to consume, investment plays an outsized role in the transmission of monetary policy shocks: because investment is very responsive to these shocks, the production of investment goods generates the temporary changes in labor income that enables high-MPC agents to spend. This motivates our concern: if structural changes in investment weaken the overall responsiveness of investment to monetary policy, or if the share of investment spending that ultimately goes to domestic wage-earners is lower, then monetary policy shocks will generate smaller responses of labor income and consumption.

2.1 Motivating Facts: Decreased Investment, Consumption, and Labor Income Responses to Monetary Policy Shocks

We begin by documenting the changing responsiveness of real labor income, real consumption, and aggregate real investment to monetary policy shocks. We estimate impulse response functions of different components of GDP to the monetary policy shocks constructed by Romer and Romer (2004) and updated by Wieland and Yang (2020). To calculate these,

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[3]This statement is equivalent to the insight from the literature on the forward guidance puzzle that current and expected deviations of the real interest rate from the natural rate are the sole determinant of consumption in standard representative agent models; see McKay et al. (2016) and Del Negro et al. (2015).

we use the following single-equation regression framework as in Romer and Romer (2004): for endogenous variable Y_t (e.g., the level of real software investment) and exogenous shock variable x_t,

$$y_t = \alpha_0 + \alpha_1 \times trend_t + \sum_{l=1}^{L} \beta_{y,l} y_{t-l} + \sum_{j=1}^{J} \beta_{x,l} x_{t-j} + \sum_{s=1}^{4} \gamma_s D_{s,t} + \mu_t \tag{1}$$
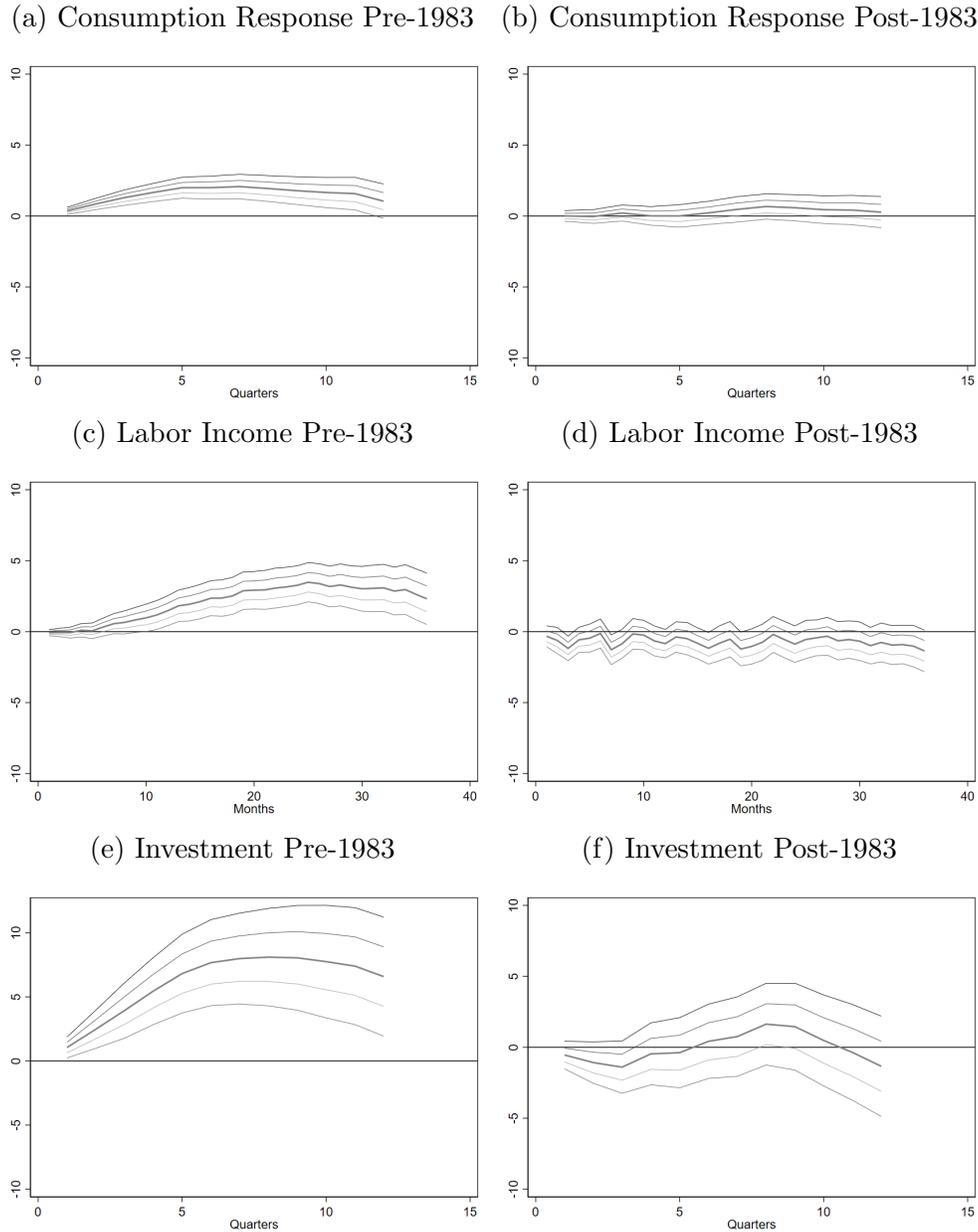
where y_t is the log difference of Y_t and the $D_{s,t}$ are quarterly (or monthly) dummies used to deseasonalize the data. Following the arguments in Baek and Lee (2022), we choose the maximum lag length of our exogenous shocks $J = 12$ quarters to be the maximum horizon for our impulse response functions and use the BIC to select L subject to the restriction $L \leq J$. Following e.g., Cloyne et al. (2020), our specification allows for a linear time trend variable $trend_t$ (though in practice the BIC rarely selects this specification). We calculate one and two standard error bands using Monte Carlo methods as in Romer and Romer (2004) and use the same sample period of years 1969 to 2007, inclusive, using the extended and updated serious by Wieland and Yang (2020) through 2007.

Figure 1 splits the response of real consumption, real labor income, and real investment to monetary policy shocks in samples from 1968-1982 and 1983-2008. We can clearly observe a profound difference in the response of consumption and real labor incomes, consistent with earlier work on the declining interest rate sensitivity of the U.S. economy (Boivin et al., 2010; Van Zandweghe and Braxton, 2013; Willis and Cao, 2015; Baldi and Lange, 2019). One potential concern is that the identification approach used in Romer and Romer (2004) may simply have gotten worse over time.[4] Additionally, it is well known that most of the large shocks occur early in the sample, so that we have less power in the later part of the sample. Thus, while we view this evidence as suggestive of the idea that monetary policy is weaker now, we will eventually turn to a structural model to understand whether secular change in the production and composition of investment goods has reduced the transmission of monetary policy shocks to real labor income and consumption.

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[4]The identification approach in Romer and Romer (2004) assumes that no new information is incorporated into Fed interest rate decisions between the formulation of the Greenbook forecast and the FOMC meeting itself, which might be a better assumption in the earlier sample (before the advent of the internet, etc.).

Figure 1: Declining Interest-Rate Sensitivity of US Consumption and Labor Income

(a) Consumption Response Pre-1983   (b) Consumption Response Post-1983

(c) Labor Income Pre-1983   (d) Labor Income Post-1983

(e) Investment Pre-1983   (f) Investment Post-1983

Notes: The effect of a 1% cut in the federal funds rate on real personal consumption expenditures (top row) and the economy-wide real wage bill (middle row), and real investment (bottom row) estimated over sample periods before and after 1983. The horizontal axis in each figure is the number of periods after the shock, either in months or quarters depending on the frequency of the underlying data. One and two standard error bands are plotted, calculated as in Romer and Romer (2004).

In the next two sections, we document two additional facts occurring against the backdrop of this apparent decrease in interest rate sensitivity: a shift in the composition of investment

spending towards categories that are insensitive to monetary policy, and a decrease in the domestic labor content of each investment category.

2.2 Explanation #1: The Composition of Investment Has Shifted Towards Less Responsive Components

This section documents a secular shift in the composition of investment away from components that are sensitive to monetary policy shocks and towards components that are much less sensitive. Note that throughout this paper, we include consumer durables in our definition of investment, as both the commodity composition of durable goods and their responsiveness to monetary policy closely resemble that of equipment investment. The commodity composition can be seen in Table 1. A similar argument applies to residential investment, and we accordingly include residential investment in our measure of investment.[5] Therefore, we will often refer to "equipment and durables" together, and we will similarly group residential investment with investment in non-residential structures, which we collectively refer to as "structures." When including durables and housing, gross private nominal investment has maintained a relatively constant share of nominal GDP around 25%[6].

Collectively, we will be most interested in three categories of investment: structures, intellectual property products (IPP), and equipment and durables (grouped together). Ultimately, these will be the three types of investment in Section 3's structural model. As we will show, the composition has shifted away from interest-rate-sensitive "tangible investment" like structures, equipment and durables and towards the much less-sensitive IPP investment, which includes R&D and software expenditures.

Figure 2 shows the changing gross nominal spending on three aggregated subcomponents

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[5]This is also partly driven by data limitations in the annual I-O Use tables, which do not distinguish between durables and non-durables consumption or residential and non-residential structures investment. We thus consider "structures" investment as a single category, and create a conservative estimate of durables consumption by assuming that commodities from certain categories (such as autos) allocated to consumption are durables. This leaves us with a conservative underestimate for the durables share of consumption relative to e.g. the NIPA estimates. Due to differences in aggregation of the retail industry in the input-output summary tables before and after 1997, we exclude retail of motor vehicles and parts from durables consumption. See Table 1 for details.

[6]Note that *net* investment has been declining as a share of GDP. This discrepancy is due to the rising depreciation share of nominal GDP, which has risen from 12% to approximately 16% in the time period studied here, as measured by the BEA consumption of fixed capital (BEA account code A262RC).

Table 1: Selected Commodity Composition of Final Demand Components, 1963-2023

| Commodity	Durables	Equipment	Structures	IPP
Computers	10.3	17.3	0.0	0
Motor vehicles, bodies and trailers, and parts	38.4	19.4	0	0
Machinery	1.8	24.6	0	0
Other transportation equipment	3.2	5.0	0	0
Electrical equipment, appliances, components	7.7	3.2	0.2	0
Furniture and related products	7.9	3.2	0.0	0
Miscellaneous manufacturing	14.1	3.3	0	0
Wholesale	0	11.4	0.2	1.1
Construction	0	0	81.6	0
Real estate	0	0	8.0	0
Support activities for mining	0	0.0	5.2	0
Misc. Prof., Sci., Tech. services	0	2.7	0.1	56.1
Computer systems design & related services	0	1.0	0	19.7
Publishing industries, includes software	11.7	0	0	7.6
Motion picture and sound recording industries	5.0	0	0	8.7
Other Commodities	0	9.8	4.4	6.8
Total	100	100	100	100

Notes: Each entry is the share of expenditures of final demand component i (column) spent on commodity j (row), averaged from 1963-2023. We assign commodities used in personal consumption expenditures to durable goods according to whether similar goods are reported in the BEA fixed asset tables, and all commodities considered that we classify as durable are included in this table. The commodity composition of consumer durable goods thus classified most closely resembles that of equipment, though there is some commonality with IPP in the use of "Publishing Industries" and "Motion picture and sound recording industries" commodities.

of private investment and durables as a share of GDP. Equipment and durables had been roughly 15% of GDP for most of the post-war period until a discrete drop following the Great Recession, to about 13-14% of GDP, with a significant bump during the COVID pandemic. Structures, combining both residential and non-residential decline from approximately 9-10% of GDP to near 7% of GDP. Gross nominal private investment in IPP has risen from below 1% of GDP to above 5% of GDP. A more detailed figure further decomposing the components can be found in Online Appendix A (see Figure A.2).[7]

Because IPP investment is much less sensitive to monetary policy shocks than other kinds "tangible" investment, this secular shift implies that, in the aggregate, investment spending is becoming less sensitive to monetary policy shocks. Figure 3 demonstrates the relative

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[7]Note that our analysis abstracts from government investment, which has fallen slightly as a share of U.S. GDP over time after booming in the 1950s and 1960s. Compared to private investment, the composition of government investment has remained relatively stable across structures, equipment, and IPP since the 1960s. See Online Appendix A for details.

Figure 2: Compositional Shifts among Investment and Durables, 1947-2023
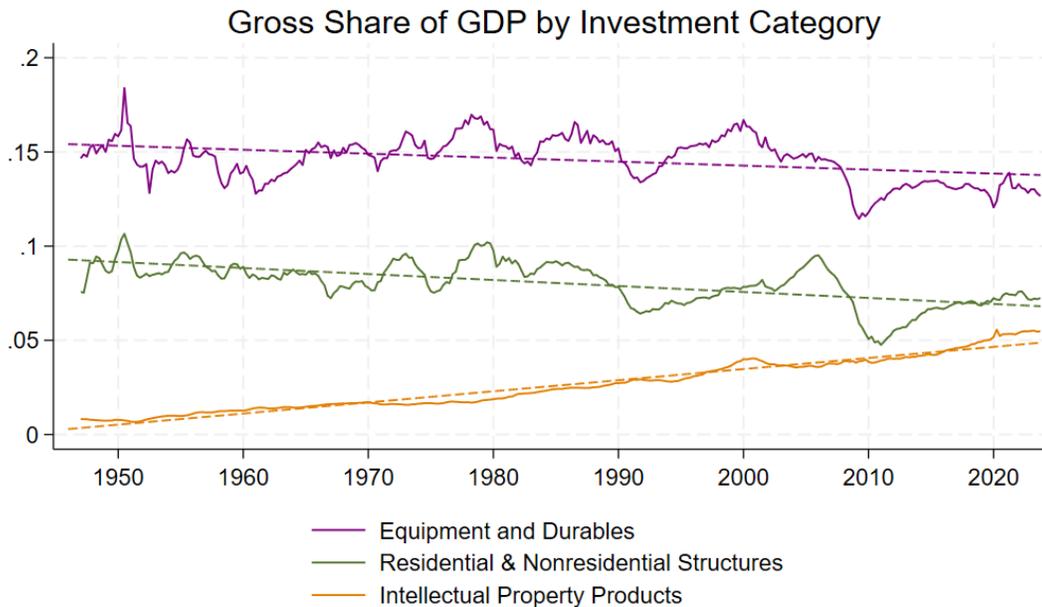
Notes: Equipment includes computers in addition to industrial equipment, transportation equipment, etc. Intellectual Property Products (IPP) has risen sharply as a share of private fixed investment, largely due to increases in software and research and development spending. All Data from NIPA Table 5.3.5. except consumer durables which is from Table 2.3.5.

insensitivity of IPP to monetary policy shocks by comparing the impulse response functions of various components of investment to an expansionary monetary policy shock, pooling the pre-1983 and post-1983 samples. Panels (a), (b), and (c) show the response of residential investment, non-residential structures, and equipment which peak at 15, 5, and 10 percent, respectively, relative to what the values would be in the absence of the shock. In contrast, the response of intellectual property products peaks at 1 percent. Panels (e) and (f) show the response of durable goods and non-durable goods, demonstrating that the response of durable goods is a similar order of magnitude as equipment and other structures, while non-durables exhibit a much weaker response. The response of PCE services, not shown here, is similarly small.

Figure 3: Response of Final Demand Components to an Expansionary Monetary Policy Shock

(a) Residential Investment

(b) Non-Residential Structures

(c) Equipment

(d) Intellectual Property Products

(e) Consumer Durable Goods

(f) Consumer Non-Durable Goods
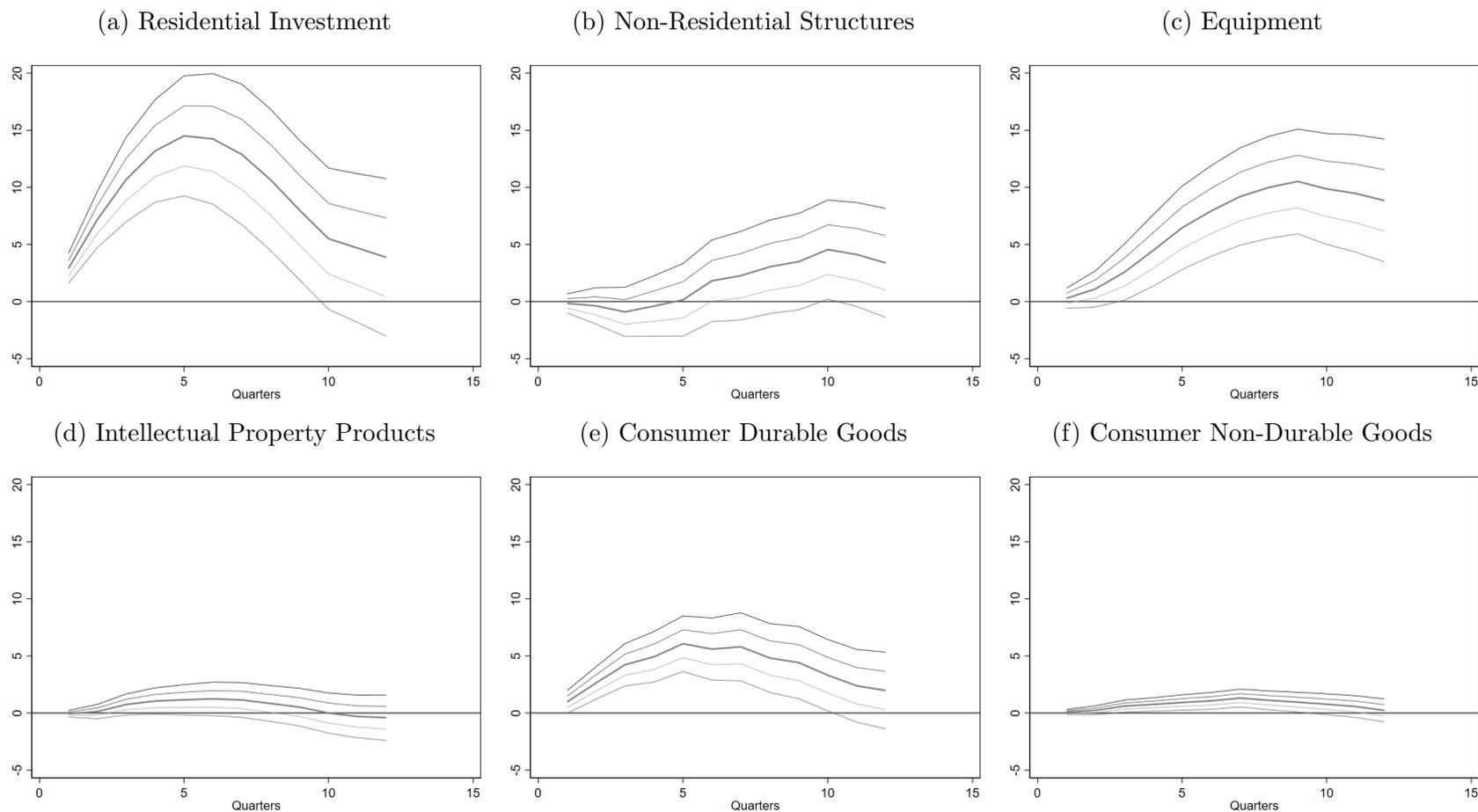
Notes: The effect of a 1% decrease in the federal funds rate on real investment and consumer goods spending, in percentage points. "Time" is quarters after the shock. One and two standard error bands are plotted, calculated as in Romer and Romer (2004). The sample period is 1969q1-1996q4, as in that paper. See text for estimation details.

These results are consistent with an empirical literature that finds IPP investment has relatively high depreciation rates (e.g., Li and Hall, 2020) and high adjustment costs (e.g., Bloesch and Weber, 2025). In Section 3's model, we will capture this relative insensitivity by calibrating depreciation rates for various types of capital to BEA estimates, and by assuming IPP has higher adjustment costs, which is standard in models that allow for both tangible and intangible capital (Moran and Queralto, 2018; Bianchi et al., 2019; Cloyne et al., 2025). At the firm level, Peters and Taylor (2017) also estimate higher adjustment costs for intangible investment.[8]

2.3 Explanation #2: Within Responsive Components, the Domestic Labor Content Has Fallen

We now document that a given dollar of investment spending does not raise domestic labor income as much as it used to. This also means that the transmission from monetary policy shocks to consumption will be dampened, as even when investment responds, it will not raise labor incomes as much today as in the past.

To show this, we first define and calculate the domestic labor content for each final use component i (equipment, non-durables and services, etc.) using the BEA Input-Output tables, performing a procedure similar to that of Hubmer (2023). The domestic labor content can be computed as:

$$dlc_t^i = \sum_k \omega_{ikt} \theta_{kt}^L,$$

where ω_{ikt} is the quantity of gross industry output from industry k demanded from a dollar of purchases of final demand component i, and θ_k^L is industry's k ratio of labor income to gross output.[9] ω_{ikt} is computed taking into account the full input-output structure of production, as well as the use of imported intermediates. The full derivation of ω_{ikt} is in Appendix B.

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[8]Differences in the nature of financial frictions facing firms engaged in different kinds of investment may also explain the differential response (Wroblewski, 2025; Cloyne et al., 2023); Section 3's model will assume only differences in depreciation rates and adjustment costs.

[9]We attribute self-employment income to labor within each industry in the same proportion as that industry's wage payments (i.e., employee income or payroll income) share of value added less self-employment income. For details of how this is constructed, see Appendix B.1.

Using a similar formula, we can compute the domestic expenditure share (defined as the share of value added going to domestic inputs) for final use component i as

$$v_t^i = \sum_k \omega_{ikt} \theta_{kt}^v,$$

where θ_{kt}^v is the value added share of gross output in industry k. To prelude the Cobb-Douglas production functions we will impose shortly, define the labor share of domestic production $1 - \alpha^i$ (defined as the share of domestic value added that goes to labor) of final demand component i to be:

$$(1 - \alpha_t^i) = dlc_t^i / v_t^i.$$

Denote the import share for final demand component i to be m^i. With simple rearranging, and noting that the import share $m^i \equiv 1 - v^i$, we can rewrite the domestic labor content as:

$$dlc_t^i = (1 - \alpha_t^i)(1 - m_t^i).$$

As demonstrated in Hubmer (2023), these empirical shares can be derived as an equilibrium outcome in an economy where industries have CES production technology and use other industries' outputs as intermediates. For our purposes, Cobb-Douglas production suffices.[10]

The first panel of Figure 4 plots the domestic labor content for investment (using the broad definition that includes durable goods and residential investment) and consumption (nondurables and services, henceforth NDS) from 1963-2023. Recall that the interpretation of this value is for every dollar spent on final investment or final consumption, how many cents are paid to domestic labor. At the beginning of this period, every dollar of final expenditure on investment generated 58 cents of domestic labor income. By the end of the sample, the domestic labor content was only 46 cents on the dollar, representing a 21% decline. Over the same period, the domestic labor content of NDS fell only from 50 cents to 46 cents. The second panel of Figure 4 performs a similar calculation for each component of investment

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[10]See Jones (2011) for a proof that in a competitive input-output economy where the producing industries operate with a Cobb-Douglas production technology in capital, labor, and intermediates, then production aggregates into an aggregate Cobb-Douglas production, where the factor proportions are a function of the industry-specific factor proportions.

separately. This plot shows that the decline in the DLC of investment is primarily due to the decline of the DLC for equipment and durable goods. The DLC of structures declined modestly, while the DLC of intellectual property products rose.

Figure 4: Domestic Labor Content of Non-Durables and Services and Investment

(a) Domestic Labor Content for NDS and Investment & Durables
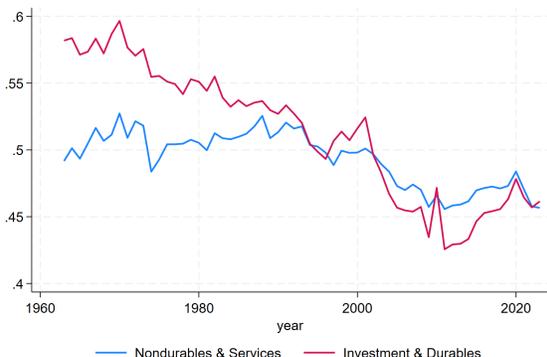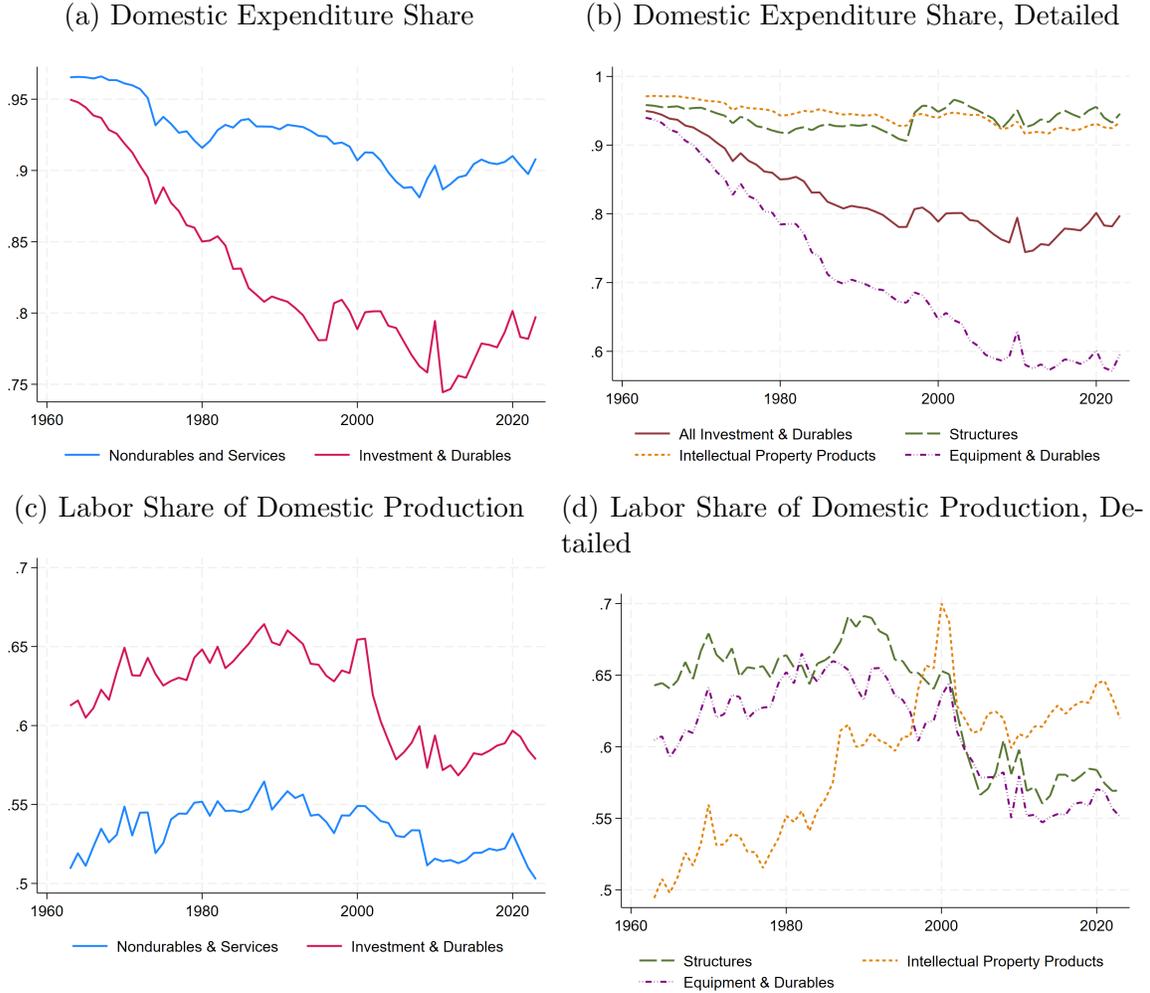
(b) Domestic Labor Content by Investment Category
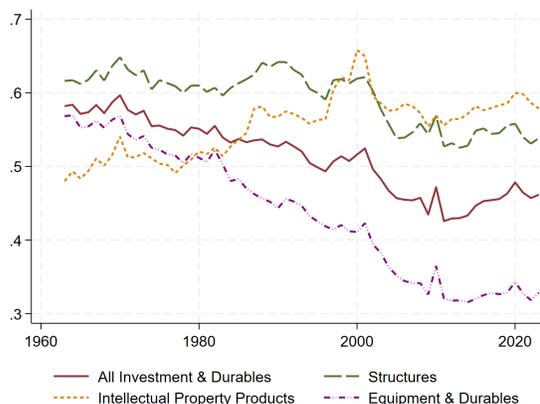
Notes: The left panel shows that the domestic labor content of non-durables and services has declined by 4 percentage points, from 0.5 to 0.46, while the domestic labor content of investment and durables has fallen by 12 percentage points, from 0.58 to 0.46, a 21% decline. The right panel plots the domestic labor content of each component of investment, revealing that the decline is driven by the falling domestic labor content of equipment and durables, which falls by over 40% from 1963-2023.

In Figure 5, we plot the decomposition of the DLC into the labor share of domestic production and the share of domestic expenditure: $dlc^i = (1 - \alpha^i)(1 - m^i)$. Figure 5(a) shows that the decline in the domestic expenditure share is driving the decline in the DLC for investment goods, and the domestic share of expenditure for NDS has changed very little since 1963.[11] Looking into the components of investment, Figure 5(b) shows that the decline in the domestic expenditure share is primarily due to a falling domestic share of equipment and durable goods. Structures and intellectual property products show almost no increase in use of imports.

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[11]One potential issue measuring the share of domestic expenditure is "re-imports": that imported goods use intermediates produced in the US. In Appendix C, we briefly discuss that this is not quantitatively important.

Figure 5: Breakdown of Domestic Labor Content by Sector, 1963-2023

(a) Domestic Expenditure Share

(b) Domestic Expenditure Share, Detailed

(c) Labor Share of Domestic Production

(d) Labor Share of Domestic Production, Detailed

Notes: These figures demonstrate that the majority of the decline in the domestic labor content for both investment and consumption has resulted from a rising share of imports, particularly for the production of investment goods.

Figure 5(c) shows that the labor share of domestic production for both investment and NDS was flat to slightly increasing from 1963 to around 2001, after which point the labor share declines in both components, though more dramatically in investment. Finally, figure 5(d) shows the labor share of domestic production for each component. The labor share in domestic IPP production has been rising over time, while it has fallen in both structures and equipment and durables.

The following section derives a small-open-economy, multisector, two-agent New Keynesian model with three kinds of investment good calibrated to match these observed declines

in the domestic labor content and shifts toward less interest-rate sensitive kinds of investment good. We will use this model to evaluate how the responsiveness of labor income and consumption to real interest rate shocks changes.

3   General Equilibrium Response to Monetary Policy

This section describes a simple small open economy New Keynesian model with two agents. We log-linearize the model around its non-stochastic steady state and study the perfect-foresight response of the economy to real interest rate shocks to demonstrate how structural changes in investment have reduced the effects of monetary policy on labor incomes and consumption in general equilibrium.[12] We follow Auclert, Rognlie and Straub (2022) in placing nominal rigidities in wage setting rather than in prices, as this allows simple calculations of relative prices of goods produced in different sectors and abstracts from issues regarding the cyclicality of monopoly profits. We also assume three different types of investment goods, with different depreciation rates and adjustment costs, to demonstrate how a shift in the composition of investment towards components that are less sensitive to monetary policy (due to relatively high adjustment costs and depreciation rates) affects the transmission of real interest rate shocks to labor income and consumption.

We use this general equilibrium model to quantify the effects of three structural changes on monetary policy: (i) a falling labor share of domestic value added, (ii) the increased import content of investment goods, and (iii) the composition shift towards less responsive components of investment. The first two changes will take the form of changing parameters in the production of investment goods. We model the composition change as a shift in the Cobb-Douglas weights in the production of capital services towards IPP.

---

[12]See Auclert, Rognlie and Straub (2022) and McKay, Nakamura and Steinsson (2016) for examples of this approach; since the linearized model features multiple equilibria given a real interest rate path, uniqueness is achieved by requiring that the economy returns to steady state at some point in the distant future. Strictly speaking it is not necessary to log linearize the model first, but when solving the nonlinear version of the model the results for the impulse response functions are nearly unchanged.

3.1 Households

All households $h \in [0, 1]$ seek to maximize the objective function

$$E_t \left[\sum_{\tau=0}^{\infty} \beta^{t+\tau} \left(\frac{C_{h,t+\tau}^{1-\sigma}}{1-\sigma} - \varphi \frac{N_{h,t+\tau}^{1+\eta}}{1+\eta} \right) \right],$$

where $N_{h,t} = \int_0^1 N_{h,n,t} dn$ are hours (or workers) supplied in n tasks from household h. There are two types of otherwise identical households: a measure $\chi \in (0, 1)$ of "Keynesian" households, who are hand-to-mouth and consume all labor income each period, as well as a measure $1 - \chi$ of "Ricardian" households, who can borrow and save in one of several assets.

On the financial side, Ricardian households trade both domestic and foreign bonds. $B_{h,t}$ denotes the quantity of riskless, home bonds in zero net supply held by (Ricardian) household h at time t, and similarly $A_{h,t}$ denotes the quantity of foreign bonds denominated in foreign currency, each of which matures at $t + 1$. $\mathcal{S}_t$ is the nominal exchange rate defined as home/foreign currency. The nominal, riskless return on the home bond is R_t and on the foreign bond R_t^f. As our model is calibrated to the U.S., we call the home currency "dollars."

On the real side, Ricardian households can also acquire three different kinds of capital by purchasing three different investment goods: Intangible capital, $IPP_{h,t}$, by purchasing Intangible Investment $I_{h,t}^p$ at real price P_t^p; equipment and durables investment $E_{h,t}$, by purchasing equipment investment $I_{h,t}^e$ at real price P_t^e; and structures capital $S_{h,t}$ by purchasing structures investment $I_{h,t}^s$ at real price P_t^s. Accumulation of IPP, equipment and durables, and structures investment are each subject to potentially different convex adjustment costs parameterized by ϕ_p, ϕ_e and ϕ_s respectively. Finally, IPP, equipment and durables, and structures capital are rented out at rates R_t^p, R_t^e and R_t^s, respectively. This yields the following household budget constraint:

$$C_{h,t} + P_t^p I_{h,t}^p + P_t^e I_{h,t}^e + P_t^s I_{h,t}^s + \frac{B_{h,t}}{P_t^c} + \frac{\mathcal{S}_t A_{h,t}}{P_t^c} = \frac{\mathcal{S}_t R_{t-1}^f \Phi_{t-1} A_{h,t-1}}{P_t^c} + \frac{R_{t-1} B_{h,t-1}}{P_t^c}$$

$$+ \int_0^1 W_{n,t} N_{h,n,t} dn$$

$$+ R_t^p IPP_{h,t-1} + R_t^e E_{h,t-1} + R_t^s S_{h,t-1}$$

$$- \sum_{i \in \{p,e,s\}} \frac{\phi_i}{2} \left(\frac{I_{h,t}^i}{I_{h,t-1}^i} - \delta_i \right)^2 P_t^i I_{h,t-1}^i$$

and the following three capital accumulation constraints:

$$IPP_{h,t} = I_{h,t}^p + (1 - \delta_p) IPP_{h,t-1} \tag{2}$$

$$E_{h,t} = I_{h,t}^e + (1 - \delta_e) E_{h,t-1} \tag{3}$$

$$S_{h,t} = I_{h,t}^s + (1 - \delta_s) S_{h,t-1}. \tag{4}$$

Note that the dollar price of the final consumption good P_t^c is implicitly used as the numeraire for the real wages $W_{n,t}$, rental rates R_t^i and investment goods prices P_t^i for $i \in \{p, e, s\}$. The variable Φ_t in the budget constraint is the "premium" which foreign assets pay over home assets, and depends on aggregate borrowing: letting P_t denote the dollar price of exports and $a_t^f \equiv \int_0^1 \mathcal{S}_t A_{h,t}/P_t dh$, we assume

$$\Phi_t = \exp\left(-\phi_a(a^f{}_t - a_{ss})\right),$$

where the parameter a_{ss} determines the steady-state of a_t; in practice this is zero and $\phi_a > 0$ is calibrated to be small so that the risk premium term Φ_t is small in equilibrium, as it is included only to solve some well-known technical issues that arise in linearized, small open economy models (Schmitt-Grohé and Uribe, 2003).

While Ricardian households have FOCs for consumption, bond holdings, and shares in the capital goods firm as shown above, the measure χ of hand-to-mouth (or "Keynesian") agents only have the condition that they consume all available labor income:

$$C_{h,t} = \int_0^1 W_{n,t} N_{h,n,t} dn.$$

Since all households will have the same labor supply (as we discuss next) this implies that all Keynesian agents obtain the same labor income in equilibrium, and we write their consumption $C_{h,t} \equiv C_{K,t}$.

3.2 Union Wage Setting

Unions for each task n set nominal dollar wages each period $\hat{W}_{n,t}$ subject to convex adjustment costs and downward-sloping demand from a labor packer who bundles labor in tasks n into aggregate labor N_t, and sells at nominal wage $\hat{W}_t$ to all final goods firms. Unions call upon their members to supply equal amounts of labor to meet demand, so $N_{h,n,t} = N_{n,t}$.[13] Further, since each union faces the same problem, they always set the same wage and face the same labor demand, so

$$N_{n,t} = N_t$$
$$\hat{W}_{n,t} = \hat{W}_t.$$

Unions set wages to maximize average expected utility of their members, putting equal weight on each household. This yields the following nonlinear wage Phillips curve: denoting gross nominal wage inflation as $\pi_t^w \equiv \hat{W}_t / \hat{W}_{t-1}$,[14]

$$\pi_t^w(\pi_t^w - 1) = \frac{\epsilon}{\psi}\left(\varphi N_t^{1+\eta} - \frac{\epsilon-1}{\epsilon} W_t N_t\left((1-\chi)C_{R,t}^{-\sigma} + \chi(N_t W_t)^{-\sigma}\right)\right) + \beta \pi_{t+1}^w(\pi_{t+1}^w - 1),$$

where ϵ is the elasticity of substitution across tasks and ψ parameterizes the costliness of changing wages. In practice, we choose φ to normalize steady state labor supply $N = 1$. We choose $\psi = 100$ and $\epsilon = 10$ to imply a slope of the nonlinear wage Phillips curve above to be equal to 0.1.

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[13]Identical labor supply is a common assumption in heterogeneous agent models with sticky wages, which allow for idiosyncratic labor income risk by multiplying identical labor supply by a scalar idiosyncratic productivity term; see e.g. Auclert et al. (2022). Allowing for fixed productivity differentials across types would introduce complexity without qualitatively changing the analysis here.

[14]For a derivation, see Appendix A3 of Auclert et al. (2024).

3.3 Rents Determined by Capital Services Firms

Perfectly-competitive capital services firms rent each of the three capital stocks from households, and combine them to produce capital services which they sell to production firms. Aggregate capital services K_t is determined by their production function,

$$K_t = \left(\frac{IPP_{t-1}}{\zeta_p}\right)^{\zeta_p} \left(\frac{E_{t-1}}{\zeta_e}\right)^{\zeta_e} \left(\frac{S_{t-1}}{1-\zeta_e-\zeta_p}\right)^{1-\zeta_p-\zeta_e}$$

governs relative productivity in the production of investment goods, and ζ_p, ζ_e are chosen to match the composition of aggregate investment spending. Final goods producers themselves rent capital services K_t, as described below:

3.4 Investment, Consumption and Export Goods Producers

All final goods production is Cobb-Douglas: letting K_t^i, N_t^i and M_t^i be the capital services, labor and imported intermediates used in sector i at time t,

$$
\begin{aligned}
C_t &= \left((K_t^c)^{\alpha_c}(N_t^c)^{1-\alpha_c}\right)^{1-m_c}(M_t^c)^{m_c} \\
I_t^p &= \left((K_t^p)^{\alpha_p}(N_t^p)^{1-\alpha_p}\right)^{1-m_p}(M_t^p)^{m_p} \\
I_t^e &= \left((K_t^e)^{\alpha_e}(N_t^e)^{1-\alpha_e}\right)^{1-m_e}(M_t^e)^{m_e} \\
I_t^s &= \left((K_t^s)^{\alpha_s}(N_t^s)^{1-\alpha_s}\right)^{1-m_s}(M_t^s)^{m_s} \\
X_t &= (K_t^x)^{\alpha_x}(N_t^x)^{1-\alpha_x},
\end{aligned}
$$

where we assume the export sector does not use imports. Each sector is perfectly competitive and sets prices flexibly, so that the labor share of value added and import shares of gross output in each sector i are constant and given by $1 - \alpha_i$ and m_i, respectively. These are calibrated to match the estimates in Section 2.3.

3.5 Rest of World: Import Price-Setting and Export Demand

We now specify how export demand X_t and the relative price of imports to exports, or inverse terms of trade, p_t^m, are determined in the rest of the world. Given our small open

economy assumption, we simply posit the following two equations: first, for export demand, we conceive of the rest of the world as one country with some exogenous income $P^f Y^f$, denominated in foreign currency. Given that P_t is the dollar price of home's exports, and $P_t/\mathcal{S}_t$ is the foreign-currency price of exports, we posit the following CES demand function:

$$X_t = \left(\frac{\mathcal{S}_t P^f}{P_t}\right)^\tau Y^f$$

so that export demand is sensitive to the exchange rate. We choose τ to target a realistic sensitivity of export demand to monetary policy shocks. For convenience, we choose P^f and Y^f (i.e., the nominal income abroad) to target a terms of trade $p^m = 1$ in steady state.

For import prices, we assume that they are based on purchases of foreign output at exogenous price P^f, and endogenous dollar price $\mathcal{S}_t P^f$. However, to match muted short run pass-through estimates of exchange rates into import prices for the United States, we assume the following functional form:

$$p_t^m = \left(\frac{\mathcal{S}_t P_t^f}{P_t}\right)^{1-\iota} (p^m)^\iota \tag{5}$$

where $\iota \in (0,1)$ is chosen to mute the pass-through of exchange rates into import prices.[15] Specifically, we choose $\iota > 0$ to avoid an unrealistic, 100% immediate pass-through from exchange rates to import prices.

3.6 Equilibrium

In equilibrium: (a) all Ricardian households optimally save and consume subject to their budget constraint and the laws of motion for capital accumulation, (b) Keynesian households

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[15] Assume home firms purchase imports from perfectly competitive retailers, who sell an import aggregate to firms which is a Cobb-Douglas aggregate of imports from two kinds of suppliers: indexers and non-indexers. Call the dollar price of non-indexers $P_t^{m,\,non-indexer} = \mathcal{S}_t P_t^f$, and call the dollar price of indexers $P_t^{m,\,indexer} = P_t \times p^m$, who we call indexers because they perfectly index their price to inflation in homes' export sector. Cobb-Douglas production implies the following for import prices:

$$P_t^m = \left(\frac{P_t^{m,\,indexer}}{\iota}\right)^\iota \left(\frac{P_t^{m,\,non-indexer}}{1-\iota}\right)^{(1-\iota)}.$$

Up to a nuisance constant, these assumptions collectively imply (5).

consume all labor income, (c) unions optimally set wages on behalf of households, (d) all perfectly-competitive firms, including the capital services firm, rent factors up until costs equate marginal benefits, (e) foreign consumption of home exports and the price of imports satisfy the two equations given above, (f) home monetary policy follows a Taylor rule and finally, (g) all markets for labor, capital, imports M_t, and financial assets clear: for labor, capital, and imports, this requires:

$$
\begin{aligned}
N_t &= N_t^p + N_t^e + N_t^e + N_t^c + N_t^x \\
K_t &= K_t^p + K_t^e + K_t^s + K_t^c + K_t^x \\
M_t &= M_t^p + M_t^e + M_t^s + M_t^c.
\end{aligned}
$$

Recall that we calibrate the model so the total labor employed in steady state is $N = 1$. For financial assets, we have both that home bonds are in zero net supply ($B_t = 0$) and that purchases of foreign bonds satisfy the balance of payments condition, which equates income from home's foreign assets and exports with purchases of new assets and imports (derived by aggregating across households' budget constraints):

$$
\begin{aligned}
P_t a_t^f + P_t^m \left(M_t^c + M_t^p + M_t^e + M_t^s \right) &= P_t X_t + \frac{S_t P_{t-1} a_{t-1}^f R^f{}_{t-1} \Phi_{t-1}}{S_{t-1}} \\
&\quad - P_t^c \sum_{i \in \{p,e,s\}} \frac{\phi_i}{2} \left(\frac{I_t^i}{I_{t-1}^i} - \delta_i \right)^2 P_t^i I_{t-1}^i,
\end{aligned}
$$

which state that total spending on new foreign assets and imported goods, in dollars, must equal total dollars earned from exports and existing foreign assets, less investment adjustment costs. Conceptually, a Taylor rule closes the model and selects a zero-inflation steady state; however, going forward, we will consider shocks to the path of real interest rates as our policy experiment of interest and so the specification is irrelevant.

3.7 The Perfect-Foresight Response to a Real Interest Rate Shock

We log linearize around a non-stochastic steady state yielding convenient, static expressions that decompose any percent deviation in consumption and labor income into simple linear combinations of the percent deviations of real investment components, real exports, and Ricardian consumption. For any variable x_t, let x be the steady state of x_t and $\hat{x}_t \equiv \log x_t - \log x$. Letting P_t^x denote the real price of exports in terms of consumption goods, aggregate consumption can be decomposed as

$$\widehat{C}_t = \sum_{i \in \{e,p,s\}} \frac{\chi dlc^i}{1 - \chi dlc^c} \frac{P^i I^i}{C} \underbrace{\widehat{(P_t^i I_t^i)}}_{\substack{\text{Real} \\ \text{Investment}}} + \frac{\chi dlc^x}{1 - \chi dlc^c} \frac{P^x X}{C} \underbrace{\widehat{(P_t^x X_t)}}_{\substack{\text{Real} \\ \text{Exports}}} + \frac{(1 - \chi)}{1 - \chi dlc^c} \frac{C_r}{C} \underbrace{\widehat{C_{R,t}}}_{\substack{\text{Real Ricardian} \\ \text{Consumption}}}.$$

$$(6)$$

See Appendix D for a derivation. For each investment component, the term $\frac{\chi dlc^i}{1 - \chi dlc^c}$ captures how the generation of labor income through production of investment goods amplifies the responses of consumption based on the domestic labor content of investment good type i and the share of hand-to-mouth agents χ. Each term also includes weights $\frac{P^i I^i}{C}$ which capture the steady state nominal shares of different investment components relative to consumption. These terms are multiplied by the percent deviation of investment from steady state, $\widehat{(P_t^i I_t^i)}$.

Thus in the presence of hand-to-mouth agents ($\chi > 0$), investment's amplification of the response of consumption to monetary policy comes from the interaction of the investment component's domestic labor content dlc^i, the investment components share in aggregate spending $\frac{P^i I^i}{C}$, and the component's responsiveness to shocks $\widehat{(P_t^i I_t^i)}$. Through structural change, a lower domestic labor content dampens amplification of equipment and durable goods by lowering $\frac{\chi dlc^e}{1 - \chi dlc^e}$. While structures remains labor intensive and responsive to monetary policy shocks, its share of aggregate spending $\frac{P^s I^s}{C}$ is falling. The rise of intellectual property products as a share of aggregate spending does little to amplify the response of consumption, as its responsiveness to monetary policy shocks $\widehat{(P_t^p I_t^p)}$ is small.

Without hand-to-mouth agents ($\chi = 0$), the production structure of the economy, including the DLC parameters, is irrelevant for the consumption response to a given change in real interest rates. This is because the consumption response of Ricardian agents, $\hat{C}_{R,t}$, is completely pinned down by the path of real interest rates through the Euler equation. Thus

changes in the investment block of the model affect the response of consumption to real interest rate shocks only because hand-to-mouth agents create a link between the generation of income and consumption.

To understand the labor income response to shocks, we turn to the following decomposition, which shows that deviations in the economy-wide real wage bill are a simple weighted average of the response of real investment, exports, and Ricardian consumption,

$$
\underbrace{\widehat{W_t N_t}}_{\substack{\text{Real Labor} \\ \text{Income}}} = \frac{N^p}{1 - \chi dlc^c} \underbrace{\widehat{P_t^p I_t^p}}_{\substack{\text{Real IPP} \\ \text{Investment}}} + \frac{N^e}{1 - \chi dlc^c} \underbrace{\widehat{P_t^e I_t^e}}_{\substack{\text{Real Equipment} \\ \text{Investment}}} + \frac{N^s}{1 - \chi dlc^c} \underbrace{\widehat{P_t^s I_t^s}}_{\substack{\text{Real Structures} \\ \text{Investment}}}
$$

$$
+ \frac{N^x}{1 - \chi dlc^c} \underbrace{\widehat{P_t^x X_t}}_{\text{Real Exports}} + \left(1 - \frac{N^p + N^e + N^s + N^x}{1 - \chi dlc^c}\right) \underbrace{\widehat{C_{R,t}}}_{\substack{\text{Real Ricardian} \\ \text{Consumption}}}, \qquad (7)
$$

where the weights N^i are the steady-state labor share in sector i, divided by $1 - \chi dlc^c$. See Appendix D for a derivation.[16] Intuitively, when we move workers out of investment goods production, or reallocate investment production towards relatively insensitive IPP, we put *more weight* on the components that are insensitive to monetary policy shocks and reduce the consumption response of hand-to-mouth agents. In short, changing the composition of investment and reducing the domestic labor content of its most sensitive components effectively moves labor out of the sectors where demand is most sensitive to monetary policy. This makes labor incomes, hand to mouth consumption, and hence, aggregate consumption, less sensitive to monetary policy as a result.

To confirm this intuition, we subject the model economy to a real interest rate shock of one hundred basis points (1%) at $t = 1$ that decays according to an AR(1) process with persistence ρ_m, and compare the results in an economy calibrated to match the 1960s vs the 2020s. As discussed above, the change in the aggregate consumption response is driven by the change in the response of labor income; accordingly, our figures and analysis will focus on understanding how the labor income response changes when moving from the 1960s to the 2020s calibration.

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[16]Note that sticky wages and flexible prices imply real wages fall in response to expansionary monetary policy shocks, but total labor income rises as hours rise.

Calibration   Table 2 summarizes the choices of parameters used in the following exercises. We set the share of hand-to-mouth agents to .33 to match the hand-to-mouth share in Kaplan et al. (2014). We set the intertemporal elasticity of substitution (IES) to 1/10 (so the inverse IES is 10), according to estimates in Best et al. (2020) who find an IES of .1. We jointly calibrate the persistence in the real rate shock ρ_m and the investment adjustment costs ϕ to match the duration and amplitude of the empirical response of investment components to a monetary policy shock, yielding $\rho_m = .9$, which is fairly standard, and $\phi_e = \phi_s = 21$ which is about 17 times smaller than the value for IPP, or $\phi_p = 350$. This is normal for DSGE models fitted to data on intangible and tangible investment separately: Moran and Queralto (2018), Bianchi et al. (2019), and Cloyne et al. (2025) all find that much higher investment adjustment costs on intangible investment are necessary to fit the data (seven, four, and over twenty times as large, respectively), and Bloesch and Weber (2025) provide a microfoundation for convex adjustment costs in the IPP sector of this sort. We set the sensitivity of export demand to the exchange rate τ to .1. While this is low relative to estimates of short-run trade elasticities, this value allows us to better match empirical estimates of changes in exports to Romer & Romer shocks. We set $\iota = .75$ to match short run estimates of exchange-rate passthrough into import prices of 25% for the U.S. (Campa and Goldberg, 2005). We set the depreciation rate for IPP $\delta_p = .06$, for equipment and durables $\delta_e = .04$, and for structures $\delta_s = .006$, targeting the average values from BEA data for our three investment concepts over the period 1963-2023.

Table 2: Parameters for Section 3's Quarterly, Small Open Economy New Keynesian Model

Calibrated Parameters: Constant Across Models

Parameter	Value	Description	Notes
β	.99	Households' Discount Factor	Calibrated to steady state real annual interest rate of 4%
σ	10	Inverse Elasticity of Intertemporal Substitution	Taken from evidence in Best et al. (2020)
η	1	Inverse Frisch Elasticity of Labor Supply	
χ	0.33	Share of hand-to-mouth agents	Taken from Kaplan, Violante and Weidner (2014).
ϕ_a	0.001	Responsiveness of the risk-premium to aggregate NFA	Chosen to be small as in Schmitt-Grohé and Uribe (2003).
a_{ss}	0	Steady-state NFA	
δ_p	.06	Depreciation rate of IPP capital	Calibrated to BEA average over our sample, 1963-2023
δ_e	.04	Depreciation rate of Equipment and Durables	Calibrated to BEA average over our sample, 1963-2023
δ_s	.006	Depreciation rate of Structures	Calibrated to BEA average over our sample, 1963-2023
ϕ_p	350	Adj. costs for IPP investment	Match empirical IRF amplitude of IPP to Romer & Romer shocks.
$\phi_e = \phi_s$	21	Adj. costs for Equipment and Durables or Structures	Match empirical IRF amplitude of tangibles to Romer & Romer shocks.
τ	.1	Sensitivity of exports to exchange rates	Match empirical IRF amplitude of exports to Romer & Romer shocks.
ι	.75	Sensitivity of import prices to exchange rates	Match short run ERPT of 25% for the U.S. (Campa and Goldberg, 2005).
ϵ	10	Elasticity of substitution across tasks	Calibrated to a markup of 10% for unions
ψ	100	Level of convex wage adjustment costs	Sets the nolinear wage Phillips-curve's slope to 0.1
$\alpha_c = \alpha_x$	.45	Capital shares in consumption and export sectors	Calibrated to estimates in Section 2.3.
m_s	.05	Import shares in Structures	Calibrated to estimates in Section 2.3.

Calibrated Parameters: 1960s vs. 2020s

Parameter	1960s Value	2020s Value	Description	Notes
ζ_p	.04	.15	Cap. Services Intensity: IPP	Targets a $\approx$15% rise in IPP share of gross investment
ζ_e	.43	.37	Cap. Services Intensity: Equip. and Durables	Targets a $\approx$10% fall in Equip. and Durables share of gross investment
α_p	.45	.40	Capital share of IPP	Calibrated to a rise of $\approx$5% in the labor share in Section 2.3.
α_e	.35	.40	Capital share of Equipment and Durables	Calibrated to a decline of $\approx$5% in the labor share in Section 2.3.
α_s	.35	.40	Capital share of Structures	Calibrated to a decline of $\approx$ 5% in the labor share in Section 2.3.
m_p	.05	.10	Import share in IPP	Calibrated to a rise of $\approx$5% in the import share in Section 2.3.
m_e	.05	.40	Import share in Equipment and Durables	Calibrated to a rise of $\approx$35% in the import share in Section 2.3.
m_c	.05	.10	Import share in consumption sector	Calibrated to a rise of $\approx$5% in the import share in Section 2.3.

Notes: the bottom table separately breaks out the parameters that vary between "1960s" and "2020s" calibrations; these are the parameter shifts considered in Table 3's decomposition exercise. The parameters φ (scaling the level of disutility from labor) and $P^f Y^f$ (nominal GDP in the rest of the world) are free parameters determining the size of the home country and the rest of the world. For convenience, we always choose φ so that $N = 1$ and $P^f Y^f$ to normalize steady-state terms of trade $P^m / P = p^m = 1$ (so that these parameters vary across calibrations).

Results We simulate how consumption responds to the 100 basis point AR(1) shock to real interest rates before and after the structural change under two different calibrations. In the first calibration, we choose parameters for a "1960's economy," where the import share of all sectors (except exports) is the same, and where we calibrate the production function of IPP so that it is as labor intensive as consumption and exports—and less labor intensive than in the two tangible investment sectors. Then, in the "2020s economy," we *increase* the labor intensity of IPP investment while *decreasing* the labor intensity of the two tangible investment sectors, roughly replicating the apparent convergence seen in Figure 5d. We also raise the import share of all sectors (except exports and structures) by 5 percentage points— except for the import share for equipment and durables which we raise by 35 percentage points. We also shift the ζ_p and ζ_e parameters to generate a shift in the composition of investment towards IPP and away from equipment and durables and structures. The full list of parameters that change and their exact values is given in Table 2.

Figure 6 plots the response in an 1960s economy (the solid black line), and the response in a 2020s economy (the dashed red line), where we shift the composition of investment goods to their 2020 values. By moving labor out of the sectors where demand is most sensitive to monetary policy, we reduce the ability of investment to amplify real interest rate shocks by raising incomes for hand-to-mouth households. Using the cumulative 12-quarter response of variables in the 1960's economy as our benchmark, the response of real consumption falls by 17% driven by a decline in hand-to-mouth consumption; Ricardian consumption is perfectly pinned down by real interest rates through the Euler equation, and does not change because the path of real rates is the same in both exercises. The response of hand to mouth consumption is identical to the response of labor income, which falls by 23% driven partly by the fall in the responsiveness of real investment but mainly by the decline in the domestic labor content of investment, as we will show below.

To understand the sources of this decline in the response hand-to-mouth consumption— equivalently, labor income—we plot separately the contributions to the percent deviation of labor income from each of the five components on the right hand side in equation (7) in Figure 7. We can see that the decline comes largely from a decline in the contribution from equipment, and to a lesser extent, from structures. The rise in the contribution from net
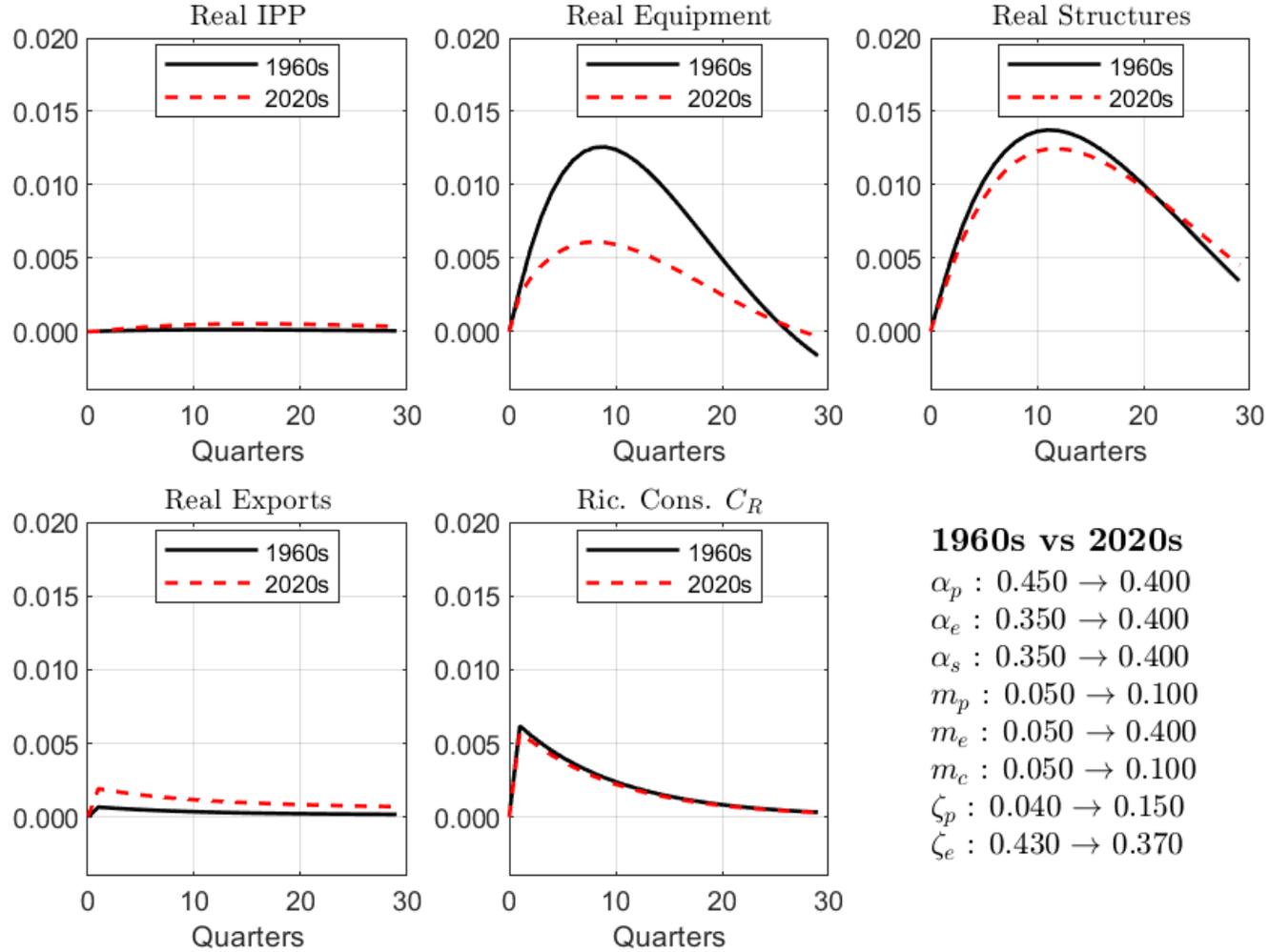
exports and IPP is not enough to offset this, and so the aggregate labor income response weakens (note that the small decline in the contribution from Ricardian consumption comes from the fact that we move some workers out of the consumption sector as the import share increases). In Figure 8, we stack these contributions to show how they sum to the entire labor income response over time, as given in equation (7).

Figure 6: Dampening Response of Consumption, Labor Income, and Investment
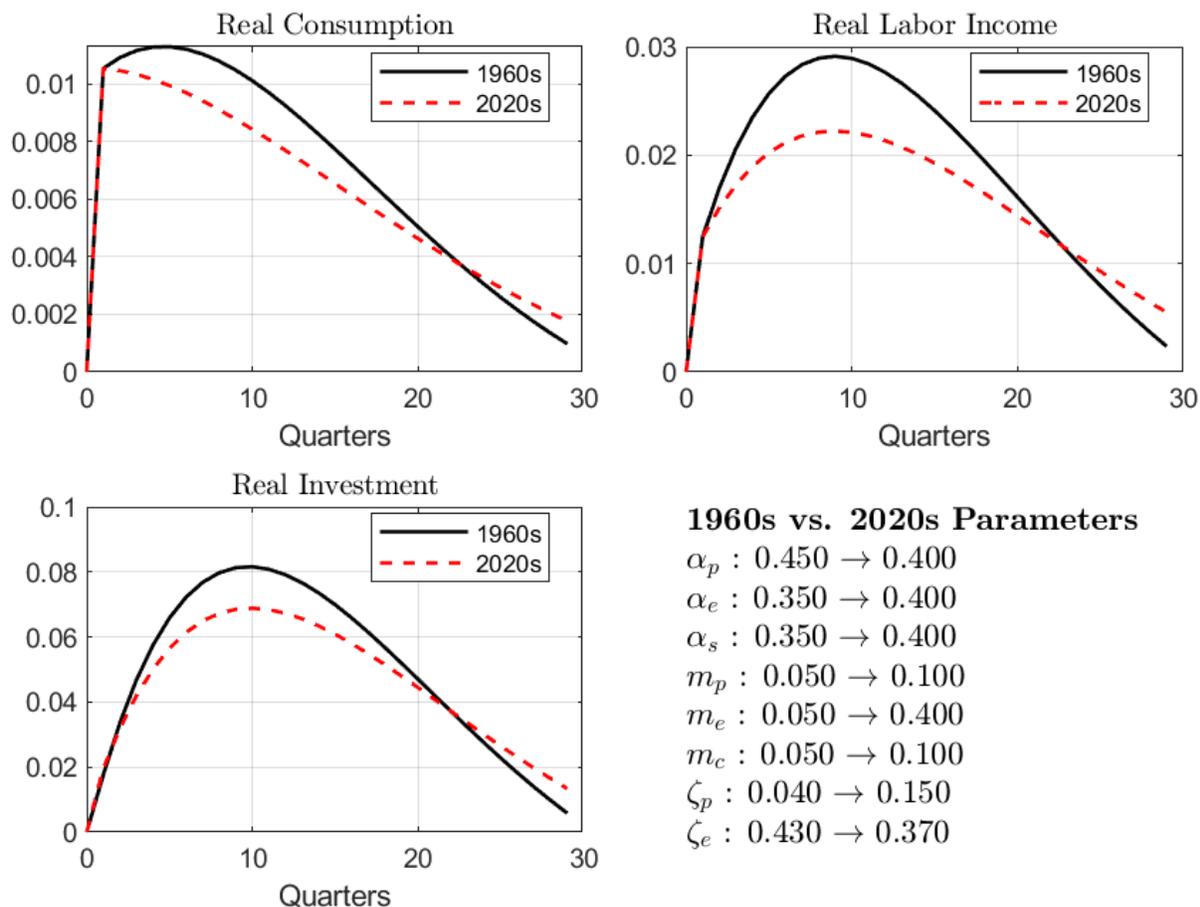
Notes: The two lines plot the response in a 1960s economy (the solid black line) and the response in a 2020s economy (the dashed red line), where we shift various production functions to their 2020 values and move labor out of the sectors where demand is most sensitive to monetary policy. This reduces the ability of investment to amplify real interest rate shocks by raising incomes for hand-to-mouth households, resulting in a decline in the overall consumption response.

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Figure 7: Contributions to the IRF of Labor Income

Real IPP

Real Equipment

Real Structures

Real Exports

Ric. Cons. C_R

1960s vs 2020s

$\alpha_p : 0.450 \to 0.400$
$\alpha_e : 0.350 \to 0.400$
$\alpha_s : 0.350 \to 0.400$
$m_p : 0.050 \to 0.100$
$m_e : 0.050 \to 0.400$
$m_c : 0.050 \to 0.100$
$\zeta_p : 0.040 \to 0.150$
$\zeta_e : 0.430 \to 0.370$

Notes: Each figure displays the contribution to labor income stemming from a response of a particular variable to an expansionary 1% AR(1) shock to the real interest rate in two calibrations of Section 3's small open economy New Keynesian model; see text for details. Each line reflects a different calibration as indicated in the legend. The contributions reflect the decomposition in equation 7.

Figure 8: Decomposing the Response of Labor Income: Stacked Contributions
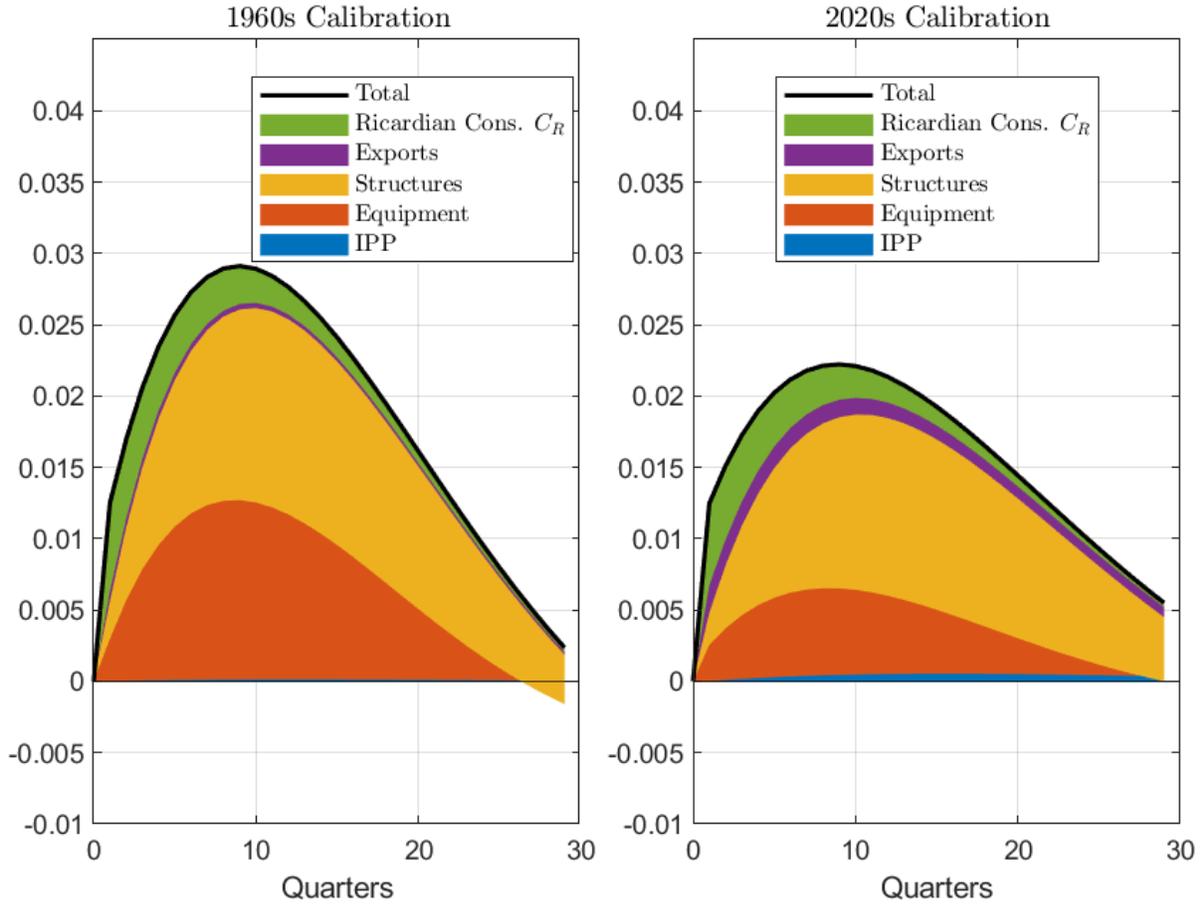
Notes: Each figure decomposes the IRF of labor income (equivalently, hand to mouth consumption) in response to an expansionary 1% AR(1) shock to the real interest rate. The contributions reflect the decomposition in equation 7. Comparing the 1960s calibration (left hand side) with the 2020s calibration (right hand side), we can see that the decline is driven largely by a fall in the contribution from equipment.

Table 3: Decomposition of the Dampened Effects of Real Rate Shocks in the Model

Structural Change	Consumption		Labor Income		Real Investment	
	Decline	Share of Total	Decline	Share of Total	Decline	Share of Total
Changing α_i Only	.030	18%	.032	14%	-.000	-0%
Changing m_i Only	.090	53%	.119	51%	.008	5%
Changing ζ_i Only	.057	34%	.088	38%	.143	93%
Sum of Individual Effects	.176	105%	.239	103%	.151	98%
Combined	.168	100%	.233	100%	.154	100%

This table decomposes the share of the dampening of the response of consumption, labor income, and real investment to shocks to real interest rates accounted for by structural changes. We compute cumulative 12-quarter responses (percent deviations) for the 1960s calibration, then change one parameter block at a time (only α_i, only m_i, only ζ_i), and finally change all three to the 2020 calibration. Shares are relative to the combined change. Declines are in percentage terms (e.g., .01 signifies a 1% decline in the response).

How important is each component of structural change in understanding the total weakening of the effect of monetary policy on labor income and consumption? To calculate this, we estimate the cumulative response of consumption, labor income and investment over the first 12 quarters following the monetary policy shock, but changing only one component of structural change at a time and keeping the other components the same as the 1960's calibration. We then report the percent difference in the 12 quarter cumulative response relative to the 1960's calibration. Table 3 shows this decomposition. In the first row, we change only the capital share parameters α_i, reflecting the changes in labor share of domestic production as seen in Figure 5c and 5d. In the second row, we change only import share m_i, reflecting the shifts in the domestic expenditure share in Figure 5a and 5b. In the third row, we change only the weights in the production of capital services ζ_i.

The results in Table 3 show that the increase in the import shares play the largest role in generating our decline in the response of labor income and consumption, followed by a large role for the changing composition of investment towards IPP. The smallest role is played by the decline in the labor share, although it is nontrivial. In contrast, the decline in the responsiveness of investment is due almost entirely to shifting the composition of investment towards IPP; changing the domestic labor content does not matter much for the response of investment to monetary policy shocks.

The Role of Net Exports   While increasing openness of the U.S. economy may weaken investment's role in amplifying the response of labor income to monetary policy shocks, there may be an offsetting force: greater openness may amplify the effect of monetary policy shocks on labor income by generating demand for labor in the export goods sector. However, the response of exports to monetary policy shocks is quantitatively small relative to investment, both empirically and in our model, which means that investment is more important than trade in determining the response of domestic labor income to monetary policy shocks.

Figure 9 reports the response of exports and imports to the same Romer and Romer (2004) shocks as in Section 2, with Figure 9(a) showing the percent deviation of exports to an expansionary monetary policy shock, and Figure 9(b) showing the response of imports. Imports respond positively in the early periods and reverts after 10 quarters, while exports

respond positively only with a substantial lag. This indicates that the response of net exports is negative in the short run in response to an expansionary shock but positive in the long run, at odds with the predictions of a standard standard Mundell-Fleming model but consistent with empirical results in Cloyne et al. (2020), Kim (2001), and Degasperi et al. (2024).

Figure 9: Impulse Response of Exports and Imports to Romer & Romer Shocks
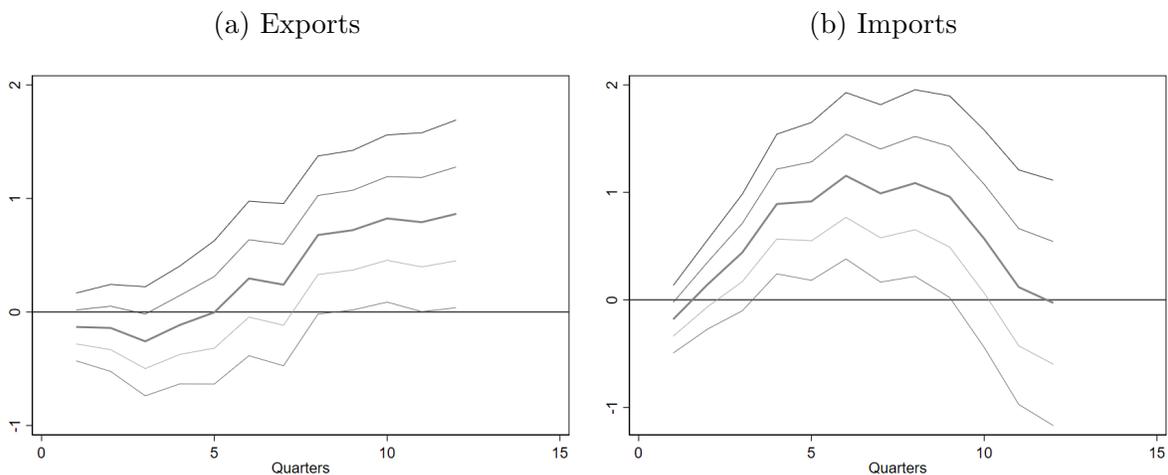
(a) Exports

(b) Imports

Notes: These figures plot the percent response of exports and imports to an expansionary shock to the federal funds rate. Imports respond positively in the early periods and return after 10 quarters, while exports respond positively with a substantial lag. At ten quarters, the effect on net exports is positive. This indicates that an expansionary monetary policy shock worsens the trade balance in the short run, while the trade balance responds positively over longer horizons, consistent with Cloyne et al. (2020)'s Figure 13, Kim (2001), and Degasperi et al. (2024).

Our calibrated model matches this negative response of net exports to an expansionary monetary policy shock, as shown in the left panel of Figure 10. This is because the short run demand for imports, primarily as inputs in investment goods, swamps the effect on demand for exports stemming from a weakened exchange rate. As the import content of investment goods grows, the demand for imports gets bigger in response to real rate shocks, amplifying the decline in net exports. As shown in the second panel, these declines in net exports are financed by a deterioration in net foreign assets. As the import share of investment goods increases, households increasingly respond to real interest rate shocks by borrowing more from the rest of the world, as shown in the right panel of Figure 10.

Figure 10: Response of Net Exports and Net Foreign Assets

(a) Net Exports

(b) Net Foreign Assets
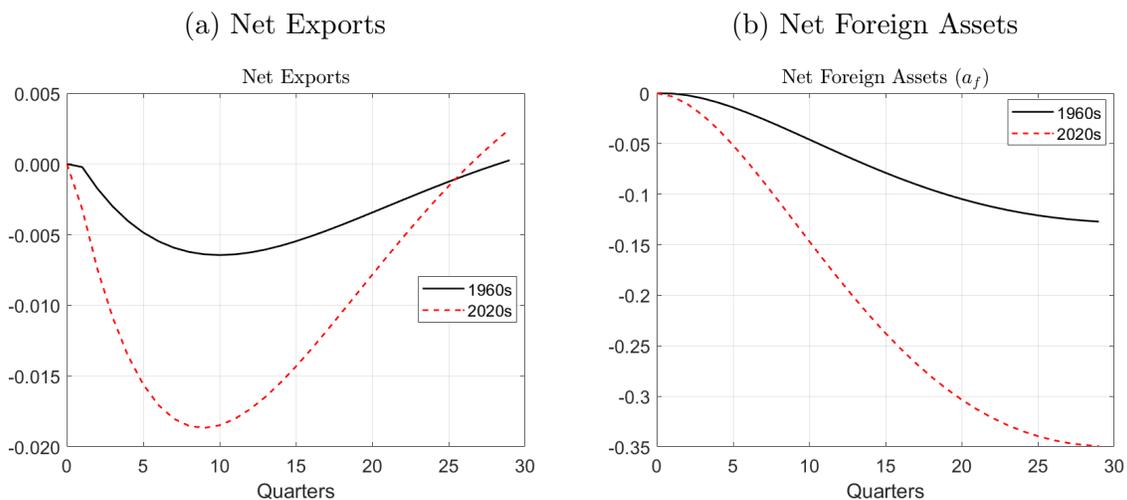
Notes: The two panels display the model response of net exports and net foreign assets to an expansionary 1% AR(1) shock to the real interest rate in different calibrations of Section 3's small open economy New Keynesian model; see text for details. The calibrations are the same as in Figure 7.

4   Conclusion

This paper has documented that secular change in both the production and composition of investment goods has weakened private investment's role in the transmission of monetary policy to labor earnings and consumption. Due to a declining domestic labor content of investment, investment fluctuations no longer amplify the effects of monetary policy shocks on consumption as they once did. Moreover, the investment response to monetary policy is likely weaker as well due to an increasing share of "intangible" investment in final demand.

These results may have important implications for optimal monetary policy. When combating high inflation, central banks in countries which have experienced secular changes in investment like those documented here for may find that it takes larger reductions in interest rates now to stimulate aggregate labor income than in previous decades. In times of low demand, policy makers should expect to find themselves constrained by the effective lower bound (ELB) on interest rates more frequently, all else equal. Further study of the implications in a more realistic, quantitative model and for dynamics surrounding ELB episodes may shed additional light on the observed tendency for open, increasingly "service based" economies to find themselves constrained by the ELB in recent decades.

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Online Appendices

A Trends in Government vs. Private Investment

As the main text abstracts from government spending, both in theory and empirics, this section briefly discusses trends in Government Fixed Investment.[17] One concern of interest is whether trends in government investment might offset the trends we document in private investment discussed in the main paper. For example, if government investment is shifting towards *more* interest rate sensitive goods, or rising as a share of GDP, that might result in increased transmission of monetary policy to consumption.

We show here that this does not appear to be the case. Figure A.1(a) demonstrates that U.S. Government investment (inclusive of Federal, State and Local spending, defense and non-defense spending, etc.) has been trending steadily downward since the 1950s and 1960s. Figure A.1(b) demonstrates that the composition of government investment has also remained largely stable since the 1960s, unlike private investment which has shifted steadily towards IPP over the same period. To see this, compare the trends for government investment in Figure A.1 to those for private investment in Figure 2 of the main text or alternatively Figure A.2 below, which breaks private investment as a share of GDP out into more detailed categories.
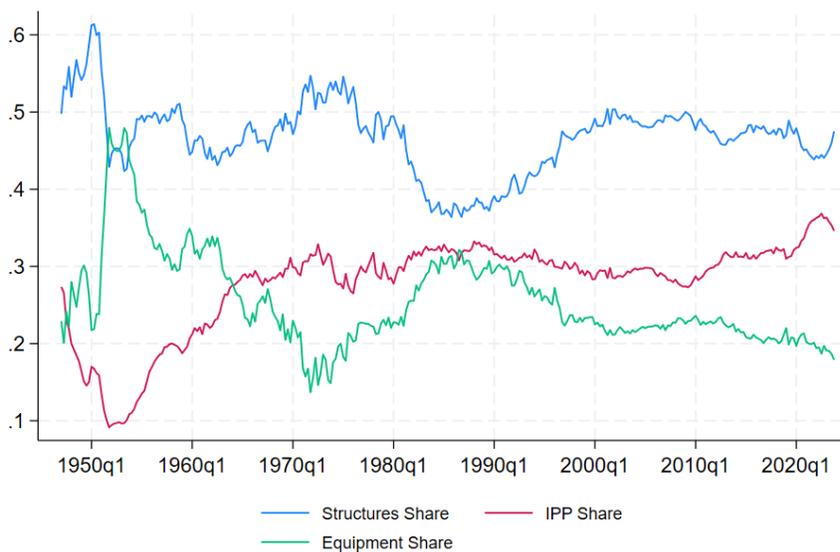
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[17]The data used here is Gross Government Fixed Investment from NIPA table 5.9.5. accessed via FRED.

Figure A.1: Government Investment Share of GDP, 1947-2023
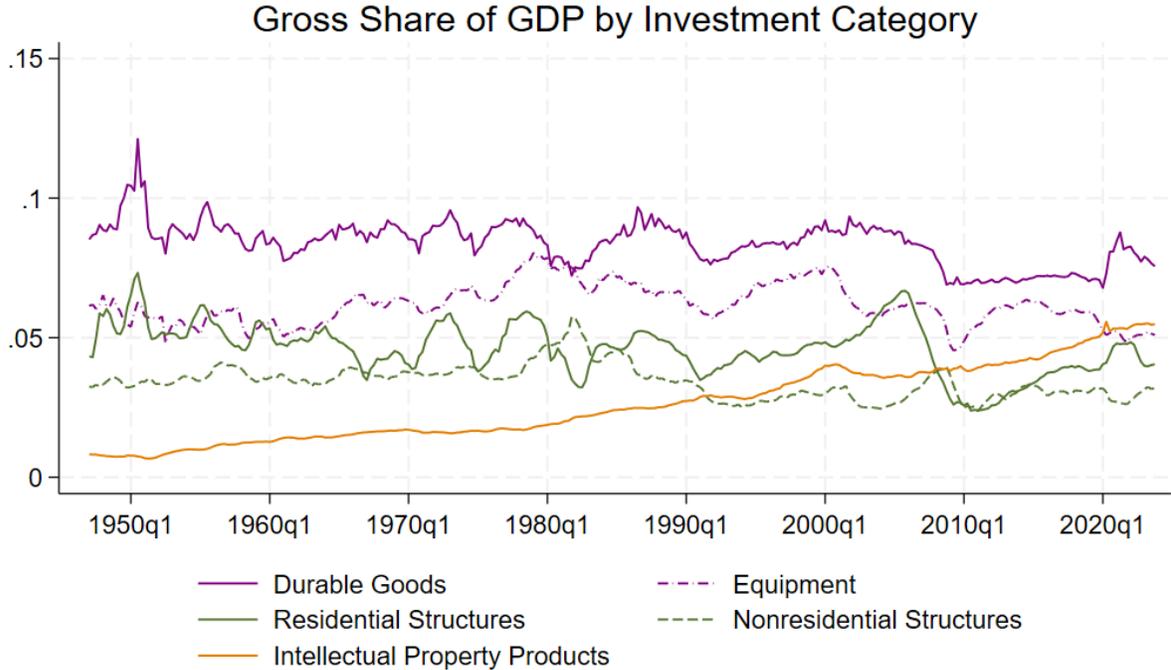
(a) Nominal Share and Linear Trend

(b) Composition of Government Investment

Notes: "Government Investment" analyzed here is Gross Government Fixed Investment, which includes both Federal and State and Local Spending, Defense and Non-Defense spending, etc. All Data from NIPA Table 5.9.5.

Figure A.2: Compositional Shifts among Private Investment Components, 1947-2023

Gross Share of GDP by Investment Category

Legend:
- Durable Goods
- Equipment
- Residential Structures
- Nonresidential Structures
- Intellectual Property Products

B Calculation of Domestic Labor Content

To compute the domestic labor content of various components of final demand over time, we use a new series of annual Input-Output (I-O) tables first released by the Bureau of Economic Analysis in 2016 (Bureau of Economic Analysis, 2024a,b) and which now span from 1963 to 2023. These tables have a consistent treatment of investment over time (in particular, for IPP investment) which is critical for our purposes.[18] We also use the import ratios from the BEA's annual Use tables in constructing the domestic total requirements tables for each year. As noted in Horowitz and Planting (2009), the BEA's source data does not allow the BEA to determine how imported commodities are distributed across using industries, and so we impute these as described below. Finally, a shortcoming of the annual BEA tables is that labor payments in each production sector are reported only beginning in 1997.[19] Additionally, the labor shares provided in the input-output tables include only employee compensation and exclude self-employment income. Therefore, to create a consistent series of the labor share by industry from 1963-2023, we rely on Jorgenson et al. (2012) and Jorgenson, Ho and Samuels (2017).

The computation of the domestic labor content begins with the make (Bureau of Economic Analysis, 2024a) and use tables (Bureau of Economic Analysis, 2024b). Using the row-by-column convention, the use table is a commodity-by-industry table, where each column states the quantities of commodity intermediates used in a given industry's production. The make table is an industry-by-commodity table, where each column shows how the production of a commodity is distributed across industries. Dividing each column of the use table by industry gross output gives the NxN direct proportions matrix B, where N is both the number of industries and commodity types. Dividing each column in the make table the sum of each column gives the NxN make-shares matrix W. Defining $\mathbb{B} = BW$, which creates a commodity-by-commodity matrix, we compute the commodity-by-commodity Leontief inverse $(I - \mathbb{B})^{-1}$. Multiplying the Leontief inverse on a column vector of commodity demand for final use ε, the term $(I - \mathbb{B})^{-1}\varepsilon$ gives the vector of values the gross commodity output

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[18]For details on the history and construction of these tables, see Lyndaker et al. (2016); for a summary, see section 11.1 of Eldridge et al. (2020).

[19]In the more detailed tables published every five years, labor's share of value is reported starting in 1982 as noted by Hubmer (2023).

demanded to produce ε commodities for final delivery.

To account for imports, we compute the "total domestic requirements matrix" as defined by the BEA. This requires two steps in addition to the process outlined above to account for imports. First, the BEA provides total quantities of imports for each commodity type. This allows us to calculate an "import ratio" γ_j for each commodity type j, which is the fraction of imports over total domestic supply (i.e., imports plus domestic production not for export). Then, because the BEA does not have the data sources to identify how imported commodities are used across industries as intermediates and as final purchases, we assume imports represent a constant fraction of any use of commodity j. Let γ be the vector of import ratios of commodities, with $D(\gamma)$ have the elements of γ on the diagonal with off-diagonal elements equaling 0, where the jth diagonal element is the import ratio for commodity j. We multiply each element of the row of the direct proportions matrix corresponding to commodity j by $1 - \gamma_j$ to get the domestic direct proportions matrix $\tilde{B} = (I - D(\gamma))B$. This captures that any time some commodity is used as intermediates, some fraction of that demand is met by imports from abroad. Then defining $\tilde{\mathbb{B}} = \tilde{B}W$, we compute the total domestic requirements matrix by taking the Leontief inverse $(I - \tilde{\mathbb{B}})^{-1}$. This matrix takes into account that for any commodity that is demanded, and for each iteration of production, some fraction of the intermediates needed to produce that commodity is met by purchases from abroad.

Let θ_k^L be the industry k's labor share of gross output and let $\bar{\theta}^L$ be a row vector of the industry labor shares of gross output. Let ε^i be the column vector of commodity demand shares for final use i, where an element ε_j^i expresses the domestic expenditure demanded of commodity j by a dollar of demand for final use i, $\sum_j \varepsilon_j^i = 1$. Then the domestic labor content is measured as $dlc^i = \bar{\theta}^L W (I - \tilde{\mathbb{B}})^{-1} (I - D(\gamma)) \varepsilon^i$, which is a scalar. Considering each of the components, the domestic total requirements matrix $(I - \tilde{\mathbb{B}})$ reports how many domestic commodities must be produced in total to produce a unit of commodities domestically. $(I - \tilde{\mathbb{B}})(I - D(\gamma))$ takes into account that when commodities are demanded domestically, some fraction of those commodities are directly purchased from abroad. Premultiplying this by the make-shares matrix W yields $W(I - \tilde{\mathbb{B}})(I - D(\gamma))$, which reports the gross industry output needed to meet domestic commodity demand. Multiplying this by ε_i

yields $W(I - \tilde{\mathbb{B}})^{-1}(I - D(\gamma))\varepsilon^i$, which is a column vector of the quantities of gross industry output demanded to produce a unit of final use i (such as equipment). The kth element of $W(I - \tilde{\mathbb{B}})^{-1}(I - D(\gamma))\varepsilon^i$ is the empirical equivalent to ω_{ik} from section 2.3. Finally, premultiplying the previous term by the row vector $\bar{\theta}^L$ sums up the labor income across industries, weighted by the gross output by industry needed to produce a unit of final use i.

We can also compute the share of each dollar spent on final use i paid domestically, which is the domestic share of expenditure. Let θ_k^v be the value added per gross output of industry k. Then let $\bar{\theta}^v$ be a row vector, of which θ_k^v is the kth element. Then, the share of domestic expenditure $1 - m^i$ is equal to total domestic value added per dollar of final expenditure, computed as $(1 - m^i) = \bar{\theta}^v W(I - \tilde{\mathbb{B}})^{-1}(I - D(\gamma))\varepsilon^i$. Lastly, we can back out the labor share of domestic production $(1 - \alpha^i) = dlc^i/(1 - m^i) = $ (domestic labor content)/(domestic share of expenditure).

B.1 Treatment of Self-Employment (Proprietor's) Income

To compute the domestic labor content of various end use categories (such as equipment, structures, intellectual property products, etc), we need to compute the labor share of value added by industry. To do so requires taking a stance on proprietor's income, i.e., the income of the self-employed. To calculate this, we employ three data sets.

- KLEMS USA labor dataset, 2013 release World KLEMS (2013) from Jorgenson et al. (2012): Labor income and hours by education level, sex, classification (employee (i.e. payroll) or self-employed/family employment/proprietors), and industry ISIC rev. 3 basis, 1947 - 2010.

- KLEMS USA basic dataset, 2017 release World KLEMS (2017) from Jorgenson et al. (2017): gross output, intermediates, and labor income (compensation of employees and self-employment income) by NAICS 2012 (summary, 71 industries) industry, 1947-2014.

- Use tables Bureau of Economic Analysis (2024b) value added by industry 1963-2023, compensation of employees (payroll) only from 1997-2023.

The challenge in creating a dataset that spans 1963-2023 is that the KLEMS 2017 data reports labor income inclusive of self-employment income by industry from 1963-2014, while the BEA input-output data report only payroll income (i.e., exclusive of self-employment income) by industry from 1997-2023. We face two specific challenges: one, calculating labor shares of value added by industry across time, and two, determining the quantity of self-employment income and deciding how to allocate self-employment income between capital and labor income.

We proceed in four steps. First, using the KLEMS USA 2013 labor dataset World KLEMS (2013), we compute the total employee compensation EC_{kt}^{13} and the total income of self-employed individuals S_{kt}^{13} by industry. Call the sum of these two objects to be "total labor income" LI_{kt}^{13}. We then compute the share of total labor income that is employee compensation for each industry: $\tilde{\theta}_{kt}^{employee,13} = \frac{EC_{kt}^{13}}{EC_{kt}^{13}+S_{kt}^{13}} = \frac{EC_{kt}^{13}}{LI_{kt}^{13}}$. We call this the "employee share of total labor income." Analogously, the self-employment share of total labor income is $\tilde{\theta}_{kt}^{selfemp,13} = \frac{S_{kt}^{13}}{EC_{kt}^{13}+S_{kt}^{13}}$.

Second, we can then compute the employee compensation and self-employment share of value added. We compute the labor (inclusive of self-employment income) share of value added from the KLEMS17 data $\mu_{kt}^{17} = \frac{LI_{kt}^{17}}{VA_{kt}^{17}}$. We then multiply this number (by industry) by the employee compensation share of total labor income to get the employee compensation share of value added by industry $\mu_{kt}^{employee}$, with $\mu_{kt}^{employee} = \tilde{\theta}_{kt}^{employee,13}\mu_{kt}^{17} = \frac{EC_{kt}^{13}}{LI_{kt}^{13}}\frac{LI_{kt}^{17}}{VA_{kt}^{17}}$. Similarly, we multiply the labor share of value added from the KLEMS 17 data by the self-employment share of total labor income to get the self-employment share of value added by industry: $\mu_{kt}^{selfemp} = \tilde{\theta}_{kt}^{selfemp,13}\mu_{kt}^{17} = \frac{S_{kt}^{13}}{LI_{kt}^{13}}\frac{LI_{kt}^{17}}{VA_{kt}^{17}}$. We can compute this for the years 1947-2010. While there is value added data available in the KLEMS 13 data set, we take ratios from within each data set because the value added data from the KLEMS 17 data line up much better with the value added by industry from the BEA input-output tables than does the value added data from the KLMES 13 data.

Figure B.1: Employee Compensation Share of Value Added in Construction: Imputed KLEMS vs. BEA Input-Output Tables
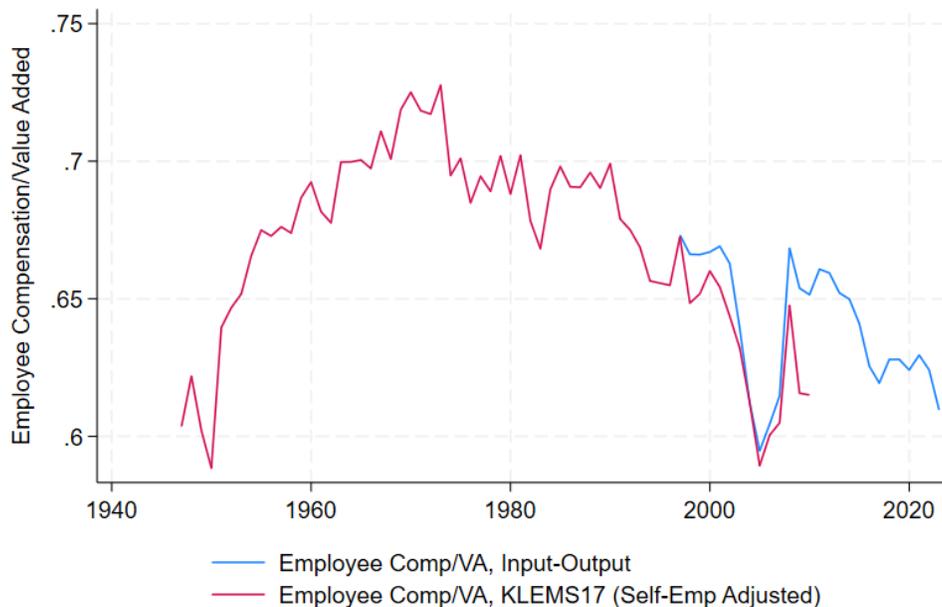
Notes: This figure reports the employee compensation share of value in the construction industry added from the Use Tables from 1997-2023, as well as the imputed employee compensation share of value added from the KLEMS data. See text for details.

Figure B.1 shows that our procedure works very well at the industry level. Figure B.1 reports the employee compensation share of value added for the construction industry from the input-output tables in blue from 1997-2023. In red is the employee compensation share of value added in the construction industry, using the labor share of value added (inclusive of self-employment) from the KLEMS 17 data, scaled down by the employee compensation share of labor income from the KLEMS 13 data. In the years between 1997 and 2010 when the all three data series overlap, the measured employee compensation share of value added and the imputed measures line up fairly well, with common movements at high frequencies. Additionally, the BEA input-ouput tables are periodically revised, and so revisions may account for some of the differences.

Having confirmed that our first and second steps of the procedure result in agreement across datasets, in the third step we extrapolate forward the self-employment share of value added through 2011-2023 using the average from 2005-2010: $\hat{\mu}_{kt}^{selfemp} = (\sum_{\tau=2005}^{2010} \mu_{k\tau}^{selfemp})/6$

for $t \geq 2011$. While a longer average could be used, we find that there are industry-specific time trends in this series and therefore decided that a shorter but more recent average would be appropriate.

Fourth, we attribute self-employment income to labor and capital income according to the same proportion of employee income by industry. That is, we compute the ratio of (employee compensation)/(value added - self employment income) = (employee compensation/value added)/(1- (self employment income/value added)) by industry using the employee compensation and value added from the I-O data EC_{kt}^{IO} and VA_{kt}^{IO} and the extrapolated self-employment shares of value added $\hat{\mu}_{kt}^{selfemp}$. This is calculated as $(EC_{kt}^{IO}/VA_{kt}^{IO})/(1 - \hat{\mu}_{kt}^{selfemp})$. We assume that this fraction of self-employment is attributed to labor each year for the given industry.[20]

Note that the industries in the KLEMS13 and KLEMS 17 datasets do not completely align (the former has ICIS revision 3 industry codes, the latter NAICS 2012). Therefore, to compute the payroll share of total labor income, we aggregate the following industries: wood, paper, and publishing industries; retail and wholesale; education, health care, government, and community services. Further details and crosswalk files are available upon request from the authors.

C Other Considerations

Fixed Costs and Mark-ups When estimating the domestic labor content, we also hypothesized that rising mark-ups may decrease the *marginal* domestic labor content - the amount of labor income generated by a marginal purchase of final demand component i. We used industry level estimates of fixed costs and mark-ups from De Ridder (2023), allowing marginal sales to not all be allocated to marginal factor payments and instead to non-labor profit. While the inclusion of fixed costs and markups lowers the level of our measure of the domestic labor content, it minimally affects the change over time.

---

[20]The are four ways we considered attributing self-employment income: attribute it all to labor, attribute it all to capital, attribute it based on the employee share of value added (less self-employment income) at the industry level, attribute it based on the employee share of value added (less self-employment income) using the economy-wide average. We find that the third and fourth options make little difference. See Elsby et al. (2013) for further discussion.

Re-imports One concern in using the input-output tables is the potential for domestic import demand to generate demand for US exports through global input-output linkages. For example, if demand for autos increases and the cars are primarily manufactured in Mexico but parts are supplied from the US, this may increase demand for labor in parts-supplying industries. However, using world I-O tables from the World I-O Database, we find trivial effects of reimports on our estimates of the domestic labor income generated.

D Decomposition of Hand-to-Mouth Consumption

First, consider log linearizing the definition of the real wage bill,

$$W_t N_t = W_t N_t^x + W_t N_t^c + \sum_{i=\{e,p,s\}} W_t N_t^i,$$

around a steady state in which φ is chosen to normalize steady state $N = 1$,

$$\widehat{W_t N_t} = N^x \widehat{W_t N_t^x} + N^c \widehat{W_t N_t^c} + \sum_{i \in \{e,p,s\}} N^i \widehat{W_t N_t^i},$$

and using the fact that the wage bill is proportional to output in each sector:

$$\widehat{W_t N_t} = N^x \widehat{P_t^x X_t} + N^c \widehat{C_t} + N^e \widehat{P_t^e I_t^e} + N^p \widehat{P_t^p I_t^p} + N^s \widehat{P_t^s I_t^s},$$

where $N^c = 1 - N^x - N^e - N^p - N^s$, and where P_t^x is defined as the real price of exports in terms of consumption goods (the same convention as P_t^i for investment good i). Finally, note that $\widehat{C}_t$ can be decomposed into Ricardian and hand-to-mouth, Keynesian consumption: working from the definition

$$C_t = \underbrace{\chi W_t N_t}_{\text{H2M Consumption: } C_{K,t}} + (1 - \chi) C_{R,t},$$

log linearize

$$\widehat{C}_t = \frac{\chi W N}{C} \widehat{W_t N_t} + \left(1 - \frac{\chi W N}{C}\right) \widehat{C}_{R,t}$$

Note that in our model, we have $\chi WN/C = \chi(1-\alpha_c)(1-m_c)/N^c$. Rewriting and eliminating the aggregate wage bill with $\widehat{W_t N_t} = \widehat{C_{K,t}}$:

$$
\underbrace{\widehat{C_{K,t}}}_{\substack{\text{Hand-to-Mouth}\\\text{Consumption}}} = \frac{N^e}{\Omega}\underbrace{\widehat{P_t^e I_t^e}}_{\text{Real Investment}} + \frac{N^e}{\Omega}\underbrace{\widehat{P_t^p I_t^p}}_{\text{Real Equipment}} + \frac{N^s}{\Omega}\underbrace{\widehat{P_t^s I_t^s}}_{\text{Real Structures}}
$$

$$
+ \frac{N^x}{\Omega}\underbrace{\widehat{P_t^x X_t}}_{\text{Real Exports}} + \left(1 - \frac{N^x}{\Omega} - \frac{N^e}{\Omega} - \frac{N^p}{\Omega} - \frac{N^s}{\Omega}\right)\underbrace{\widehat{C_{R,t}}}_{\substack{\text{Ricardian}\\\text{Consumption}}}
$$

where $\Omega \equiv 1 - \chi(1-\alpha_c)(1-m_c)$.

Derivation in terms of Domestic Labor Content: Start from the identity for the real wage bill,

$$
W_t N_t = \sum_{i \in \{e,p,s\}} W_t N_t^i + W_t N_t^x + W_t N_t^c, \tag{1}
$$

where N_t^j denotes labor used in sector $j \in \{c, x, e, p, s\}$. Using that, in each production sector $j \in \{c, e, p, s\}$, the wage bill is a constant share of nominal revenue: defining PY_t^j be nominal, dollar revenue in sector j, and recalling $\hat{W}_t$ is nominal, dollar wages:

$$
\widehat{W_t} N_t^j = (1-\alpha_j)(1-m_j)\, PY_t^j, \qquad j \in \{c, e, p, s, x\}, \tag{2}
$$

(with $m_x \equiv 0$ for exports), evaluating in steady state and expressing all prices in units of the final consumption good gives the following: recalling P^j is the (steady state) dollar price of investment good i relative to the dollar price consumption P^c for $j \in \{e, p, s, x\}$,

$$
N^i = (1-\alpha_i)(1-m_i)\, P^i \frac{P^c}{\widehat{W}} I^i, \qquad i \in \{e, p, s\}, \tag{3a}
$$

$$
N^x = (1-\alpha_x)\, P^x \frac{P^c}{\widehat{W}} X \tag{3b}
$$

$$
N^c = (1-\alpha_c)(1-m_c) \frac{P^c}{\widehat{W}} C \tag{3c}
$$

Next, log-linearize the aggregate consumption identity

$$C_t = \chi W_t N_t + (1 - \chi) C_{R,t}, \tag{4}$$

to obtain

$$\widehat{C}_t = \frac{\chi WN}{C} \widehat{W_t N_t} + \left(1 - \frac{\chi WN}{C}\right) \widehat{C}_{R,t}. \tag{5}$$

Using equation (1) and the fact that $\widehat{W_t N_t^j} = \widehat{P Y_t^j / P_t^c}$, we can write

$$\widehat{C}_t = \frac{\chi WN}{C} \left[\sum_{i \in \{e,p,s\}} N^i \widehat{(P_t^i I_t^i)} + N^x \widehat{(P_t^x X_t)} + N^c \widehat{C}_t \right] + \left(1 - \frac{\chi WN}{C}\right) \widehat{C}_{R,t}, \tag{6a}$$

Then plugging in for N^j using equations (3a)-(3c) above:

$$\widehat{C}_t = \frac{\chi WN}{C} \left[\sum_{i \in \{e,p,s\}} \left((1 - \alpha_i)(1 - m_i) P^i \frac{I^i}{W} \right) \widehat{(P_t^i I_t^i)} \right.$$
$$+ \left((1 - \alpha_x) P^x \frac{X}{W} \right) \widehat{(P_t^x X_t)} + (1 - \alpha_c)(1 - m_c) \frac{C}{W} \widehat{C}_t \Bigg]$$
$$+ \left(1 - \frac{\chi WN}{C}\right) \widehat{C}_{R,t}, \tag{6b}$$

Substituting $\frac{\chi WN}{C} = \chi(1 - \alpha_c)(1 - m_c)/N^c$ and collecting terms in $\widehat{C}_t$ on the left hand side yields, after using the normalization $N = 1$ in steady state,

$$\left(1 - \chi(1 - \alpha_c)(1 - m_c)\right)\widehat{C}_t = \chi \sum_{i \in \{e,p,s\}} (1 - \alpha_i)(1 - m_i) \frac{P^i I^i}{C} \widehat{(P_t^i I_t^i)}$$
$$+ \chi(1 - \alpha_x) \frac{P^x X}{C} \left(\widehat{\frac{P_t^x X_t}{P_t^c}}\right) + (1 - \chi(1 - \alpha_c)(1 - m_c)/N^c) \widehat{C}_{R,t}. \tag{7}$$

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To write more compactly, define the (new) weights

$$\bar{\Omega} \equiv \frac{\chi}{1 - \chi(1 - \alpha_c)(1 - m_c)} \qquad \text{and} \qquad \bar{\Omega}^c \equiv \frac{1 - \chi(1 - \alpha_c)(1 - m_c)\frac{1}{N^c}}{1 - \chi(1 - \alpha_c)(1 - m_c)}. \qquad (8)$$

Then equation (8) can be written compactly as

$$\widehat{C}_t = \bar{\Omega} \sum_{i \in \{e,p,s\}} (1 - \alpha_i)(1 - m_i) \frac{P^i I^i}{C} \widehat{(P_t^i I_t^i)} + \bar{\Omega}(1 - \alpha_x) \frac{P^x X}{C} \widehat{(P_t^x X_t)} + \bar{\Omega}^c \widehat{C}_{R,t}. \qquad (9)$$

Where note $N^c < 1$ implies $\bar{\Omega}^c < 1$. Using that $C = \chi C_k + (1 - \chi)C_r$, we have that

$$\frac{(1 - \chi)C_R}{C} = 1 - \chi(1 - \alpha_c)(1 - m_c)\frac{1}{N^c}$$

Which means that

$$\bar{\Omega}^c = \frac{C_r}{C} \frac{1 - \chi}{1 - \chi dlc^c}$$

So equation (9) can be written even more compactly as

$$\widehat{C}_t = \underbrace{\sum_{i \in \{e,p,s\}} \frac{\chi dlc^i}{1 - \chi dlc^c} \frac{P^i I^i}{C} \widehat{(P_t^i I_t^i)}}_{\text{Investment Fluctuations}} + \underbrace{\frac{\chi dlc^x}{1 - \chi dlc^c} \frac{P^x X}{C} \widehat{(P_t^x X_t)}}_{\text{Export Fluctuations}} + \underbrace{\frac{(1 - \chi)}{1 - \chi dlc^c} \frac{C_r}{C} \widehat{C}_{R,t}}_{\text{Ricardian Consumption}}.$$