Subjective Models of Workers and Managers for Macroeconomic Expectations

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Any modern macroeconomic model implicitly assumes that all economic agents form expectations and make choices based on a unique set of incentives and beliefs about the relationships between economic variables that derive from the model's assumptions. That is, a single set of assumptions is shared by all agents, irrespective of whether the model is based on a representative agent or allows for heterogeneous characteristics and incentives and whether it is frictionless or allows for the presence of frictions in equilibrium, so that all agents follow a single set of "rules of the game."

And yet, recent evidence suggests that this implicit and undisputed tenet of economics might be unrealistic because agents hold different subjective models of the macroeconomy (Andre et al., 2022; Flynn and Sastry, 2022). Subjective models derive from different narratives to which agents adhere about whether and how economic variables are related, which can lead to heterogeneous beliefs about macroeconomic and personal economic variables and hence heterogeneous economic choices even by observationally similar agents (Andre et al., 2024; Beutel and Weber, 2022; D'Acunto et al., 2024*a*,*b*).

In this paper, we propose the first steps toward assessing the heterogeneity (or lack thereof) of subjective models of the macroeconomy and their implications for the formation of beliefs and choices across two types of agents whose matching and interactions are ubiquitous in microeconomic and macroeconomic models—firms and workers. Firms' beliefs shape their investment, labor demand, and financing decisions, whereas workers' beliefs their labor supply, consumption, saving, and human capital accumulation decisions (D'Acunto and Weber, 2024). Recent evidence shows that beliefs about the same economic variables appear to be systematically different between firms and the workers that firms employ (Buchheim, Link and Möhrle, 2024; Jain, Kostyshyna and Zhang, 2024), which could lead to suboptimal outcomes for wage bargaining, layoff, hiring, and hours worked (Pilossoph and Ryngaert, 2024).

To investigate the extent to which subjective models might differ across firms and workers and whether this difference could lead to systematically different beliefs, choices, and reactions to economic shocks, we design and field a new survey of firms and workers in New Zealand building on the survey frame used by Coibion, Gorodnichenko and Kumar (2018) and Kumar, Gorodnichenko and Coibion (2023).

I. Survey Structure

Our survey was administered to representative populations of firms and workers in New Zealand across two waves (starting in October 2022 and in January 2023) and was conducted via phone interviews to maximize respondents' attention and response rates. We surveyed 1,445 managers and 1,658 workers. The survey contained questions to elicit respondents' subjective models, economic beliefs, and planned choices as well as vignettes proposing hypothetical alternative monetary-policy scenarios to measure the sensitivity of respondents' be-

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liefs and choices to interest-rate shocks.

Following standard phrasing in the literature (Weber et al., 2022), we elicited numerical point forecasts for 1-year- and 4-year-ahead inflation, unemployment, and policy rates (called *official cash rates* in New Zealand). We also elicited inflation and unemployment rate perceptions. We elicited these questions twice after the description of each of two hypothetical scenarios of monetary policy, except for the questions about inflation and unemployment, which we also asked before the scenarios were introduced. The first scenario (*baseline scenario*) asked respondents to imagine that at the first meeting after taking the survey, the Reserve Bank of New Zealand (RBNZ) would announce that the cash rate would stay unchanged at the level of 4.25%, which was the level when our first survey wave started. The second scenario (*alternative scenario*) asked respondents to imagine that the RBNZ would announce unexpectedly a 100-basis-point increase in the cash rate and that this increase would be a one-off divergence from the originally intended path of future interest rates.[1] This scenario design allows us to construct within-respondent measures of the reactions of beliefs to an unexpected monetary-policy shock rather than between-subjects measures typical of information experiments. At the same time, respondents are aware that at most one scenario might realize and hence their answers need to be interpreted as hypothetical reactions, whereas in an information experiment subjects react to truthful statements (Coibion, Gorodnichenko and Weber, 2022).

II. Subjective Models of the Macroeconomy: A Classification

Our aim is not as ambitious as trying to map the subjective relationships and directions of causality across all possible pairs of macroeconomic variables. Rather, we focus on the relationship between two macroeconomic variables that should be especially relevant for firm managers' and workers' decisions—inflation and unemployment. Previous research shows many households perceive higher future inflation to be associated with higher future unemployment, which motivates this choice (Kamdar, 2018; Coibion et al., 2023).

We compute the sign of respondents' expected change in inflation over the following 12 months relative to their perceived inflation over the previous 12 months ($\Delta\pi^e$) and equivalently for the aggregate unemployment rate over the same horizon (Δu^e). Recall these questions were purposefully also asked before we introduced the scenarios and we only consider the pre-scenario answers in this stage. We then compare the signs of the expected changes in inflation and unemployment to construct mutually exclusive subjective models of the macroeconomy based on all possible combinations. We label the five resulting subjective models as follows:

- Positive demand shocks ($\Delta\pi^e > 0$ and $\Delta u^e < 0$)
- Negative demand shocks ($\Delta\pi^e < 0$ and $\Delta u^e > 0$)
- Positive supply shocks ($\Delta\pi^e < 0$ and $\Delta u^e < 0$)
- Negative supply shocks ($\Delta\pi^e > 0$ and $\Delta u^e > 0$)
- Acyclical ($\Delta\pi^e = 0$ and $\Delta u^e = 0$).

This definition does not imply that subjective models are state-independent: the same agent might hold different beliefs about future inflation and unemployment relative to past realizations under different states of the economy (Weber et al., 2023).

Figure 1 reports the distribution of subjective models for firm managers (left bar) and workers (right bar) and reveals two facts. First, within each group, we detect substantial cross-sectional heterogeneity in subjective models—agents largely disagree about the future evolution of inflation and unemployment based on past perceptions. Second, and perhaps even more surprising,

[1] Because of a monetary-policy change announced on November 23, 2022, the cash rate levels were updated for respondents recruited after the announcement.

the distributions are almost identical: in both groups, about one third of agents hold beliefs and perceptions that align with the prevalence of negative demand shocks over the following 12 months, whereas supply-side-shock views absorb about half of the agents split equally between positive and negative shock views. Only about one sixth of respondents' beliefs and perceptions are consistent with a positive demand shock view of the economy.

The similarity of the distributions across agent types is not inconsistent with earlier evidence that firms and workers have different beliefs about unemployment but not about inflation (Buchheim, Link and Möhrle, 2024). In fact, we confirm this result below. Rather, it suggests that the directions in which agents believe inflation and unemployment will change relative to their perceptions are similarly heterogeneous for firms and workers.

III. Beliefs and Reactions to Shocks: Firms vs. Workers

Regarding the distributions of 1-year-ahead point estimates for inflation and unemployment we detect facts that are consistent with earlier research (untabulated). First, even though the mean and modal numerical inflation expectations of managers and workers are similar, inflation expectations are more dispersed among workers, which is consistent with evidence from Germany by Link et al. (2023). Second, workers are systematically more pessimistic about unemployment than firm managers, which is also consistent with evidence from Germany (Buchheim, Link and Möhrle, 2024).

We assess how firm managers' and workers' beliefs react to the same hypothetical monetary policy shock by computing, for each respondent, the difference between the point estimates of subjective expectations we elicit after the scenarios are introduced (cash rate, inflation rate, and unemployment rate) under the alternative and baseline scenarios. Figure 2 reports the averages of these differences plotted separately for firm managers (dark gray) and workers (light gray) at the two horizons we consider (1-year- and 4-year-ahead).

Beliefs about the cash rate react similarly across groups (panel (a)). On average, over one year, rates are believed to barely differ across the two scenarios. Workers think they will be slightly higher under the alternative scenario relative to firm managers but this difference is small and barely significant. By contrast, in the medium term, both firm managers and workers think that the cash rate will be lower under the alternative scenario. Both types of agents expect that a hypothetical current increase in the cash rate would lead the RBNZ to cut the cash rate more aggressively in the medium run relative to the baseline scenario. Our wording of the alternative scenario stated explicitly that the RBNZ had no intention to change the future path of interest rates after a sudden current increase but managers and workers seem to believe that this intention is not time consistent.

In panel (b), firm managers and workers vary substantially, on average, in the extent and timing at which they believe a one-time positive shock to the cash rate transmits to inflation. At the one-year horizon, managers believe that inflation will be curbed by about 50 basis points after the unexpected current increase of the cash rate by 100 basis points. Conversely, workers believe that inflation will only be 10 basis points lower under the alternative scenario. The reactions are inverted at the four-year horizon. When faced with the same monetary policy tightening measure, firm managers believe in a large and immediate effect on inflation, whereas workers believe in a smaller and delayed effect.

Moving on to unemployment expectations (panel (c)), at the one-year horizon, managers and workers have similarly heterogeneous beliefs as with inflation. In the medium term, though, neither managers nor workers believe that a sudden increase in the cash rate today will affect the unemployment rate relative to the unemployment rate that will prevail if the cash rate stays unchanged.

IV. Reactions to Shocks by Subjective Models: Firms vs. Workers

Firm managers and workers appear to hold substantially different beliefs about the extent to which a sudden and unexpected increase in policy rates might transmit to inflation and unemployment, relative to a scenario in which policy rates stayed unchanged. In this section, we investigate whether agents' subjective models of the macroeconomy might contribute to explaining this heterogeneity. We estimate the following multivariate linear specification by OLS:

$$\Delta\,\mathbb{E}\,r_i \text{ or } \Delta\,\mathbb{E}\,\pi_i = \alpha + \sum Subjective\ Model_{ik} + \epsilon_i, \tag{1}$$

where $\mathbb{E}\,r_i$ ($\mathbb{E}\,\pi_i$) is the difference between agent i's 12-month-ahead cash rate (inflation) expectations under the alternative scenario relative to the baseline scenario, and $Subjective\ Model_{ik}$ are indicator variables that equal one if agent i is classified as holding subjective model k, and zero otherwise. The omitted category is the *Positive demand shock* model.

Table 1 reports the estimated coefficients for the samples of workers (odd columns) and firm managers (even columns). Subjective models modulate the transmission of the shock to the future cash rate and inflation differently for workers and managers. The economically small expected persistence of the shock we detected above for workers is shared similarly by respondents holding different subjective models of the macroeconomy. By contrast, the average lack of transmission we detected for firm managers masks substantial heterogeneity by subjective models. Managers who hold beliefs consistent with positive future demand shocks, who are captured by the constant, believe in an economically and statistically sizable effect of the shock on future cash rates (10 basis points over the following 12 months). By contrast, managers whose beliefs align with negative demand shocks or positive supply shocks think that the 1-year-ahead cash rate will not react or even react negatively.

For inflation expectations we also detect a different role of subjective models across workers and firm managers. Only workers who hold a positive demand shock view and, to a smaller extent, those who expect inflation and unemployment to be the same under the two scenarios (*Acyclical*) believe that a higher cash rate can curb inflation. By contrast, all firm managers believe that a monetary policy tightening will curb inflation in the short term.

V. Concluding Remarks

This paper proposes a first step into studying the subjective models of the macroeconomy held by firm managers and workers. Subjective models are highly heterogeneous across agents but their distributions within the groups of firm managers and workers are strikingly similar. At the same time, the extent to which subjective models modulate beliefs about the reactions of macroeconomic variables to a monetary policy tightening varies systematically between firm managers and workers. Whereas firm managers differ in their expected persistence of a sudden monetary policy tightening on future cash rates based on their subjective models, workers do not. And, whereas workers differ in the extent to which they believe a monetary policy tightening might curb inflation in the short term based on their subjective models, firm managers do not.

Future research should build on these initial results. Empirically, measuring subjective models and assessing their implications for firm managers' and workers' economic decisions are broadly open areas of inquiry. Theoretically, developing models that allow for heterogeneous subjective models seems unavoidable given the mounting evidence that subjective models are heterogeneous, shape belief formation, and lead similar agents to react differently to the same economic shocks.

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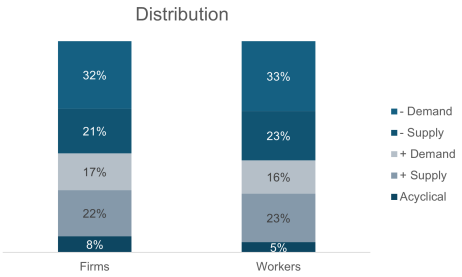

FIGURE 1. DISTRIBUTION OF SUBJECTIVE MODELS: FIRM MANAGERS VS. WORKERS

Note: This figure plots separately for firm managers (left bar) and workers (right bar) the shares of respondents whose subjective beliefs and perceptions of inflation and unemployment are consistent with each of the five subjective models of the macroeconomy we define in Section II.

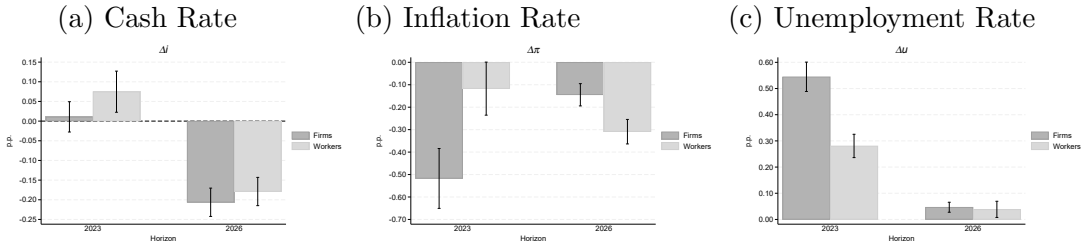

FIGURE 2. DISTRIBUTION OF SUBJECTIVE BELIEFS: FIRM MANAGERS VS. WORKERS

Note: This figure plots the averages, along with the 95% confidence intervals, for firm managers (dark gray) and workers (light gray), illustrating the difference between the rate-increase scenario and the baseline across two horizons (1-year and 4-year ahead). The panels show results for the cash rate (panel (a)), inflation (panel (b)), and the unemployment rate (panel (c).

	$\Delta\,\mathbb{E}\,r$ 2023		$\Delta\,\mathbb{E}\,\pi$ 2023	
	(1)	(2)	(3)	(4)
Positive Supply	0.08	-0.12*	0.47**	0.36
	(0.09)	(0.07)	(0.21)	(0.22)
Negative Demand	-0.03	-0.15**	0.49**	0.23
	(0.09)	(0.06)	(0.20)	(0.22)
Negative Supply	-0.00	-0.09	0.49**	0.25
	(0.09)	(0.07)	(0.22)	(0.23)
Acyclical	-0.01	-0.01	0.20	0.12
	(0.14)	(0.09)	(0.30)	(0.29)
Constant	0.06	0.10**	-0.49***	-0.75***
	(0.07)	(0.05)	(0.17)	(0.17)
R^2	0.00	0.01	0.01	0.00
Observations	1,527	1,250	1,526	1,259
Sample	Workers	Firms	Workers	Firms

Table 1—Reactions of Subjective Expectations by Subjective Models: Firm Managers vs. Workers

Note: This table reports the estimate of multivariate OLS specifications. In each column, we regress the difference between the 12-month-ahead expected interest rate (columns (1) and (2)) or expected inflation rate (columns (3) and (4)) under the alternative scenario relative to the baseline scenario separately for workers (odd columns) and firm managers (even columns) on a set of indicator variables for the subjective models of the macroeconomy we define in Section II. The Positive demand shock model is the omitted category. Statistical significance is indicated as follows: * 10%, ** 5%, *** 1%.